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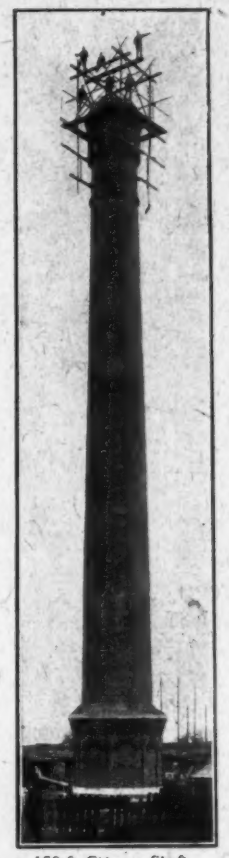

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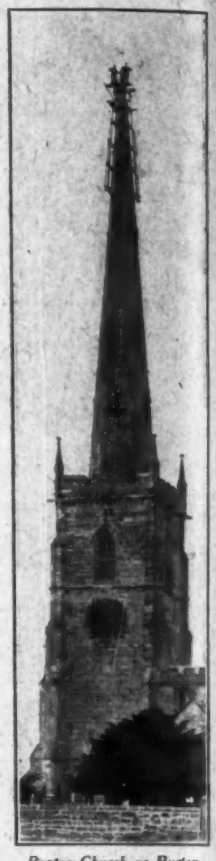

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ELECTRICAL REVIEW.

VOL. XC. MAY 5, 1922. No. 2,319.

ELECTRICAL REVIEW.

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THE ENGINEERING LOCK-OUT.

THERE is little enough of compliment to be presented to any of the three parties to the dispute which is now obstructing the engineering industry, and which constitutes the chief domestic obstacle to the revival in trade that is so persistently trying to materialise. What little there is, however, may be offered to the Government for having at last set up an Industrial Court to investigate the causes of, and make known the facts concerning, the difficulties which exist. The desirability of this step was first urged by us over a month ago, but the Government then believed that delay would thereby be caused and the area of the dispute extended. The area of the dispute extended itself, without any help from an Industrial Court, and the delay of four weeks or more that has occurred might have been avoided by prompter action on the part of the Minister of Labour.

In support of the statement that trade is trying to revive, we may remark that improvement is recorded by responsible persons connected with the following industries: boots, hats and caps, pig iron, cotton, wool, chemicals, South Wales coal, and Birmingham exports. The managing director of one of the largest electrical manufacturing concerns has been publicly quoted as saying that the input of orders has lately improved, that inquiries are more plentiful, and that if labour conditions were more settled, the industry would make rapid strides in the direction of recovery. In passing, we may remark that there is ample room for the coal trade to revive still further by making a reduction of fifty per cent. or so in the price of domestic coal. The wages dispute in the cotton industry, which at one time threatened to lead to a stoppage, has been amicably adjusted, and congratulations are due to both sides for having avoided an interruption to business. We have once before quoted *The Times* of February 24th last as saying: "These things have been successfully done in other industries, and can be done in the engineering industry." Here is an example of the truth of that statement. A stoppage has been avoided in the cotton industry, and we cannot help feeling that a stoppage might have been avoided in the engineering industry.

When confronted with a difficulty, or a problem of any kind, it is always useful to ask two questions about it. The first is: *What is it that we want?* and the second is: *What is preventing us from getting it?* Well, now, what do we want in the engineering industry? There can only be one answer, viz., good trade and plenty of employment. And why are we not getting it? Too high wages, say some; and as a consequence wages are reduced. A Labour correspondent writing in *The Observer* of April 30th states that "over a substantial proportion of British industry, wages, taking into account the cost of living and leaving aside the present

unemployment, are as low as they were before the war, and among large numbers of workers, a good deal lower." If we accept this as true, it is clear that we have cast adrift from any idea of an improved standard of living. Too high profits, say others. This will unfailingly be proved erroneous when the balance-sheets for 1922 are produced. So far as we are able to foresee, many of the engineering dividends that are paid on this year's trading will be paid out of moneys carried forward; and unless more business can be obtained, 1923 will show an even worse state of things. Too high overhead charges, perhaps. It is true that railway charges, postal expenses, hotel prices, and other expenses connected with selling and delivering goods are, on the average, at least twice what they were before the war. None of these suggestions gives—taken all together they do not give—an adequate answer to the question.

The real and sufficient reason is lack of business. The cure of unemployment is fundamentally a selling problem. The war has been finished for a long time now, and it is high time things got back into their normal stride. Whether we like it or not, if we are to avoid starving here in England we have got to trade with Russia; we have got to trade with Poland; we have got to increase our trade with France; aye, and we have got to trade with Central Europe. Particularly is this true of the engineering industry. The cotton industry can sell its goods in tropical countries, and it is unlikely that the slump in cotton will ever be so complete as it has lately been in our own industry. We do not profess politics in these columns. We are accused by an employer of reading nothing but *The Communist* and *The Herald;* on the other hand, a worker has told us that we have not the foresight or the wish to state a case for labour. We think it likely, from these comments, that we have succeeded in our intention of being quite impartial. But politics or no politics, it is devoutly to be hoped that the Prime Minister will, by the time these lines are before our readers, have succeeded in establishing at Genoa a basis upon which the commercial structure of Europe can be rebuilt. By this means it will be possible to extend the market for British goods; employment will be more plentiful and unemployment will decrease; if there were no unemployment there would be no objection to overtime, and one ostensible cause of the lock-out would disappear.

We see, then, that even the present dispute depends for its solution on the restoration of stability in Europe. The "snarling," to use Mr. Lloyd George's expression, at home is an echo of the snarling between the nations. The Industrial Court will reveal the truth about internal conditions, and what is wrong with them must be set right. The two sides have published statements of their views, and the chief impression gained from reading them carefully is that a regrettable obstinacy has been displayed by both. The employers have not been as wise and tactful as could have been wished, but the insistence of the engineers on the "verdict" of their ridiculous and farcical ballot (at which 320,000 did not take the trouble—or did they have the opportunity?—to vote) is such as to become irritating. Let us put the fact quite plainly. The A.E.U. executive accepted the terms of November last, which were put to the men, and *they were not rejected*. They were not accepted, it is true, but let us carry the case to the point of absurdity. Suppose only one man had taken the trouble to vote, and he had voted against the terms; would that have been accepted as a valid result? or, if he had voted in favour of the terms, would the men have accepted that? If not, where is the limit to be drawn, between 20 per cent. and one individual? The A.E.U. will have to adopt Mr. Clynes's advice, and forget the indecisive ballot on the November terms. The stubbornness of the employers has culminated in a public invitation to the men individually to break away from their union, and this while the Court of Inquiry is sitting. The sittings of the Industrial Court are to be held in public—this is as it should be.

Are Whitley Councils a Success?

In a recent issue, commenting upon the claim of labour to be represented on the Joint Electricity Authorities, we said that the industry was already fully provided for in this respect by the National Industrial Council and the District Councils. In our "Correspondence" columns last week we published a letter in which the sufficiencies of the Whitley Councils were challenged from the Union side. This, of course, was only an individual opinion, and we do not think it reflects the general feeling of the Trade Union with regard to the Councils any more than the occasional secession of some small aggrieved undertaking is indicative of the general feeling of the employers.

Still, among those who are not in touch with the Councils the question is sometimes asked whether after all they are really a success, and the points raised by our Trade-Union correspondent are just those which would naturally arise. He claimed that a number of electricity undertakings refused to conform to the decisions of the Councils; that some of the Employers' representatives on the Councils did not follow the recommendations in their own undertakings; and that there was a distinct failure in carrying out the spirit of the Whitley Councils in the present national sliding scale agreement which, he suggested, was forced on the Trade-Union side. Now these statements are not in accordance with the facts.

In the first place, we can say that the National and District Councils in the electricity supply industry have been an unqualified success. By this we do not mean that there has not been failure on all sorts of small points; much less do we mean that everybody concerned has been pleased. It is obvious that you cannot for three years settle basic rates and the up and down adjustments for the employés of 500 undertakings without somebody feeling aggrieved on one side or the other. But considering the magnitude of the task, what troubles have actually ensued? How many electricity undertakings have refused to conform to any decision of any Whitley Council, as suggested by our correspondent? Practically none of any size and importance, and even in total, very few indeed. Even amongst the few the grievance has usually been on some specific point, sometimes a quite small one. Moreover, it will be found that these comparatively few unimportant undertakings actually do follow very generally the recommendations of the Whitley Council, and if we take the number of workmen who belong to these disgruntled undertakings we shall find that tney form an insignificant fraction of the total number of employés in the industry. The big undertakings, such as Manchester, Glasgow, Birmingham, Bradford, Sheffield, Newcastle, the two dozen or so big municipal and company undertakings in London, and the mass of medium-sized undertakings throughout the country, have given the fullest adherence to the Whitley system from the beginning. Then as to the actual members of the employers' side loyally carrying out the recommendations of the Council, this again might apply to the representative of some few small company or municipal undertakings, whose directors or councillors do not support him. But if lists were made of the undertakings which have loyally supported the Whitley Councils throughout and those which have refused to do so, it would be found that the latter were entirely negligible. Even when we come down to the question mentioned above of the National Sliding Scale Agreement by which the wages of all workmen throughout the country are reduced as the cost of living falls, far from this being merely a sectional agreement, it has been adopted by both sides of each of the 13 District Councils, and has been in satisfactory operation for some months.

But if we are to realise the great success of the Whitley Councils in this industry, we must take a broad view. Since Whitley Councils have been in operation, strikes and lock-outs have been practically unknown, and this during a most critical period of adjustment of wages. Compare the history of the electricity supply industry

with that of the engineering industry, or any other big industry, during the last three years, and the contrast is astounding. Not a single dispute of any magnitude between the employers and the workmen has arisen in the electricity supply industry during this period, and not one that has led to a strike at any important undertaking. To realise what the Whitley Councils have done for the industry, one has only to imagine the chaos which would have ensued during this critical period if the 500 undertakings in this country had tried to settle their own problems individually and independently with their own workmen or the two or three dozen Trade Unions interested in the industry.

Above all, a firm basis of mutual understanding and sympathy has been established between both sides. We have only to look at the engineering industry at the present moment and the deplorable lock-out, resulting from the lack of just this understanding, to realise the value of the work done by the Councils in this direction. We desire once more to emphasise the value of direct personal association between employers and workpeople, for the interchange of thoughts and opinions; by no other means can mutual confidence and esteem be brought into being. To such intercourse the parties must bring the will to seek agreement and to study the facts from the other's point of view as well as their own. No rational person would take a hand at a game of whist with the idea of getting the better of his partner, besides defeating his opponents—"play not one hand alone, but both combined!" That is the spirit in which capital and labour should play the game of industrial organisation, for their joint benefit; and it is the spirit which pervades the principles of Whitleyism.

Those who talk lightly of the Councils in the electricity supply industry or affect to think that the industry might be just as well off without them are doing the industry the greatest disservice, and by the industry we mean equally the workmen and the undertakings themselves. So far as our experience is concerned, we have found that these adverse criticisms originate either with those who know nothing of the work of the Councils or of the industrial situation generally, or with those who criticise the Councils merely as part of some extraneous argument. Those who know most about the Whitley Councils are their strongest supporters.

Swiss Franc and German Mark.

Switzerland is suffering probably more than any other country from the so-called "exchange dumping" which has resulted from the depreciation of the German mark. In machinery Germany has been able at times to undersell Switzerland to the extent of 70 per cent., for the German manufacturer has been able to buy his raw material for about one third of the price paid by the Swiss maker, whilst his wage bill has been about one-tenth. The prosperity of Swiss industry depends so largely upon export trade that the depression in Central and Eastern Europe has been very severely felt by it, and this sensitiveness has been increased owing to the high exchange value of the Swiss franc. For these reasons Swiss manufacturers will welcome the reports that in certain classes of goods Germany is losing her capacity to undercut international prices. The possibility has been under discussion for some time. The tremendous advantage from the selling point of view of the depreciated mark has been to some extent offset by the larger amount of currency needed in the purchase of raw materials from abroad. On the other hand it has to be taken into consideration that the cost of raw material has much less influence on the final cost than the wage bill has, and that, in this latter respect, Germany retains a weighty advantage. Yet there is evidence that high cost of production is telling against Germany's competitive power in export trade in certain lines, whether this be due to increased expenditure on fuel, raw material, wages, or all combined. Her prices are said to have almost reached the world's level in heavy iron and steel, steam engines and the better-quality woollens. In order to reduce costs, the firms concerned in the production of electrical porcelain are arranging to transfer the manufacture from Berlin and district to neighbourhoods where labour is cheaper. It cannot be said that there are yet many signs of German electrical machinery and apparatus rising in price above international parity, but if the high quotations in certain lines are genuine and not due merely to inability to give prompt delivery, it seems more than probable that the same tendency will be noticeable in electrical goods.

If German manufacturers had any steadfast belief in the continued advantage in export trade of the depreciated mark, they would scarcely arrange to start branch factories abroad. Yet, as a recent Berlin dispatch to *The Times* stated, an agreement has been entered into between the Siemens-Schuckert Co. and a Japanese firm, by which the Siemens Co. will construct a large factory in Tokio for the output of electrical machinery. How seriously the Swiss electrical industry has been affected by German undercutting is shown in the report by H.M. Commercial Secretary at Berne, which is summarised in another column.

The I.E.E. Council Election.

Extra-Council nominations, bringing up the number of candidates to nine for three vacancies, have ensured that there shall be a ballot for the Member class; and one extra-Council nomination for the Associate Member class has fortuitously saved the Council from what would otherwise have been a "regrettable incident" in the shape of a reissue of nominations.

Amid so admirable an array of candidates it is somewhat difficult, and possibly invidious, to make a choice; but we think it will be generally agreed to be in the interests of the industry that Mr. J. W. Beauchamp, director of the E.D.A., shall be elected. Another candidate who similarly unites official position with personal qualities of a high order is Mr. A. C. Cramb, hon. secretary of the I.M.E.A. The services which Mr. A. M. Sillar has rendered to the industry, not only in his professional capacity but particularly on the social side, should surely count in his favour; and Major Kenelm Edgcumbe would undoubtedly be a valuable acquisition to the Council. Not one of these gentlemen has ever been a member of Council.

A Helpful Budget.

The Budget introduced by Sir Robert Horne, the Chancellor of the Exchequer, on Monday last, and now under consideration by the House of Commons, is the first in which an attempt has been made since the European war to relieve British trade and industry of part of the oppressive burdens thrown thereon by the cost of the war itself, and by the extravagance of national expenditure which followed it. The Chancellor, in intimating the decisions or recommendations of the Cabinet, reduces the Income Tax impost by one shilling in the pound, and industry, so sadly in need of a tonic, is thankful for this small mercy. It looked for a larger reduction and for the abandonment of the iniquitous Corporation Tax as reliefs which were essential in order to give an impetus to business enterprise, but any reduction at all is a move in the right direction, especially as it suggests that other falls will follow. The reductions in postal charges have been welcomed by everybody, but they, too, are insufficient. When the increases were made they had the immediate effect of discouraging the circulation of business-getting literature; it is expected that many schemes of this kind may now be proceeded with and some of the lost trade recovered. The reduction of telephone charges, for which a million pounds is stated to be available, should also bring relief to traders; but at the time of writing we do not know how the reductions will be allocated. On the whole, we welcome the Budget as indicative of returning sanity and as affording some encouragement to industry.

D

HYDRO-ELECTRIC DEVELOPMENT IN BOLIVIA.

By WILLIAM T. TAYLOR, M.Inst.C.E., M.I.E.E.

The following particulars of a hydro-electric undertaking in Bolivia, the execution of which involved a number of unique features, may be of interest to readers of the Electrical Review:—

The great amount of constructional work and the expense involved in the complete hydraulic works for a power plant consisting of five 650-h.p. units seems well worthy of mention. Coal is not mined in Bolivia or in any other near-by country. The development was carried out in a remote part of the world under great difficulties and at an altitude ranging between 14,600 and 13,025 ft. above sea-level. The development was the most economical and the nearest to the

Fig. 1.—Hydro-electric Power Station; River Bed in Foreground.

power market (Pulacaya and Huanchaca), which was 50 miles distant from the power-house site. The scheme as a whole represents, perhaps, the extreme outside limit of financial responsibility a company or party would go to in the construction of any hydro-electric system in that the cost per h.p. developed and its relation with the amount of power capable of development was very excessive—something like four times the ordinary average cost for such works. Suffice it to say that the cost was warranted in view of the fact that the minimum price for coal (pre-war) was, for bulk supplies, never less than £5 per ton, and the pilferage, wastage, and other losses before reaching the boilers amounted to about 15 per cent.

The watershed takes in a large area of the southern slope of the Frailes range of mountains (Cordillera de los Frailes), draining into the two rivers, Rio Visicza and the Rio Cagua. At a point about one mile above the present head-works these two rivers meet and continue as one stream flowing into a narrow gorge and passing the site of diversion and head-works, which latter are located at the extreme head of what is known as the Yura Valley, the residential site of a race called the Yura Indians.

The rainy season commences in the month of November and ends in February. Its effect on the average stream-flow is to increase it several times, but is not destructive like many of the South American rivers during the period of rains. The dry season commences in the month of May and ends in the month of August; its effect on the present hydraulic development is of little consequence. The average flow of water is at the rate of 300 cubic feet per second.

The intake to the canal and conduit is located at an elevation of 13,025 ft. above sea level. The total length of the conduit is seven miles. It consists of natural rock-cut, masonry-lined, concrete-lined, and timber-lined canal, two siphons, thirteen masonry, steel, and wooden bridge-flumes, and twenty-eight tunnels. The average grade for the total length of conduit is approximately 1.1 ft. per 1,000 ft.

The amount of tunnel construction work involved (for the most part through solid rock) is given in the following tabular form:—

Tunnel Work.

No.	1	tunnel	290 ft. long	No.	15	tunnel	211 ft. long
,,	2	,,	285 ft. ,,	,,	16	,,	958.5 ft. ,,
,,	3	,,	249 ft. ,,	,,	17	,,	1,287 ft. ,,
,,	4	,,	152 ft. ,,	,,	18	,,	1,950 ft. ,,
,,	5	,,	566 ft. ,,	,,	19	,,	739 ft. ,,
,,	6	,,	79 ft. ,,	,,	20	,,	165 ft. ,,
,,	7	,,	227 ft. ,,	,,	21	,,	326.5 ft. ,,
,,	8	,,	835 ft. ,,	,,	22	,,	92.5 ft. ,,
,,	9	,,	114 ft. ,,	,,	23	,,	322 ft. ,,
,,	10	,,	69 ft. ,,	,,	24	,,	643.5 ft. ,,
,,	11	,,	72.5 ft. ,,	,,	25	,,	465 ft. ,,
,,	12	,,	211 ft. ,,	,,	26	,,	249.5 ft. ,,
,,	13	,,	668 ft. ,,	,,	27	,,	901.5 ft. ,,
,,	14	,,	1,407.5 ft. ,,	,,	28	,,	1,250 ft. ,,

that is, nearly 2.8 miles of tunnel work, sections of which had to be timber-lined.

Another very expensive piece of work was that of the steel and masonry bridge flumes; the cost of these portions of the hydraulic works was excessively high. The amount of bridge-flume work involved is indicated in the following:—

Bridge Flumes.

No. 1 steel flume	438 ft. long
No. 2 steel flume	24.5 ft. long
No. 1 timber flume	13.3 ft. long
No. 2 timber flume	10.5 ft. long
No. 1 masonry flume	180 ft. long
No. 2 masonry flume	30 ft. long
No. 3 masonry flume	135 ft. long
No. 4 masonry flume	53 ft. long
No. 5 masonry flume	25.5 ft. long
No. 6 masonry flume	6.9 ft. long
No. 7 masonry flume	13.3 ft. long
No. 8 masonry flume	79 ft. long
No. 9 masonry flume	20 ft. long
No. 10 masonry flume	13.3 ft. long
No. 11 masonry flume	20 ft. long
No. 12 masonry flume	6.9 ft. long
No. 13 masonry flume	7 ft. long

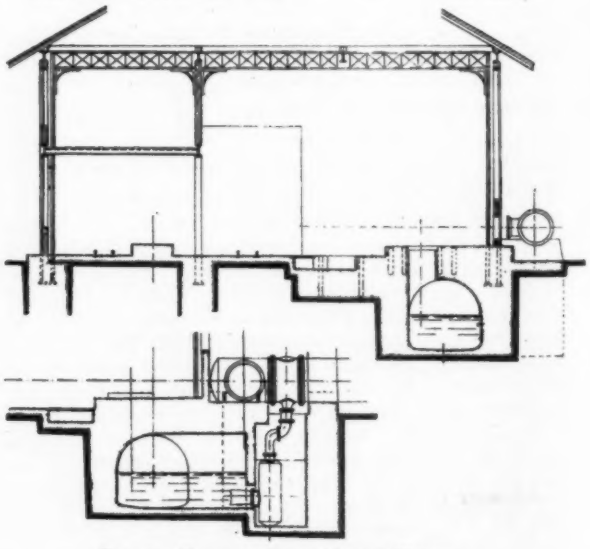


Fig. 2.—End-section of Power House.
Fig. 3.—Bottom End of Penstock, showing Relief Valve.

or, 1,065 ft. span of bridge-flume construction work. In each case a reliable water-course had to be made before building up the masonry work to carry the flume structure.

In addition to the tunnels and bridge flumes enumerated above, two steel siphons were installed, each 5 ft. in diameter and of the following span and depth:—

Steel Siphons.

"Molino" siphon ...	304 ft. clear span.
	54 ft. vertical depth.
"Chauro" siphon	410 ft. clear span.
	63 ft. vertical depth.

The survey of the 7-mile conduit-route was made in a rugged and for the most part precipitous mountain range situated well above the "timber-line" or "belt" (*i.e.*, a high altitude at which trees and grass cannot grow). The tunnel work, the bridge-flume work, and the water-courses crossing the conduit-route, each required individual study before a decision could be given as to the best lay-out and the most suitable hydraulic properties of the different sections of conduit for the grade chosen.

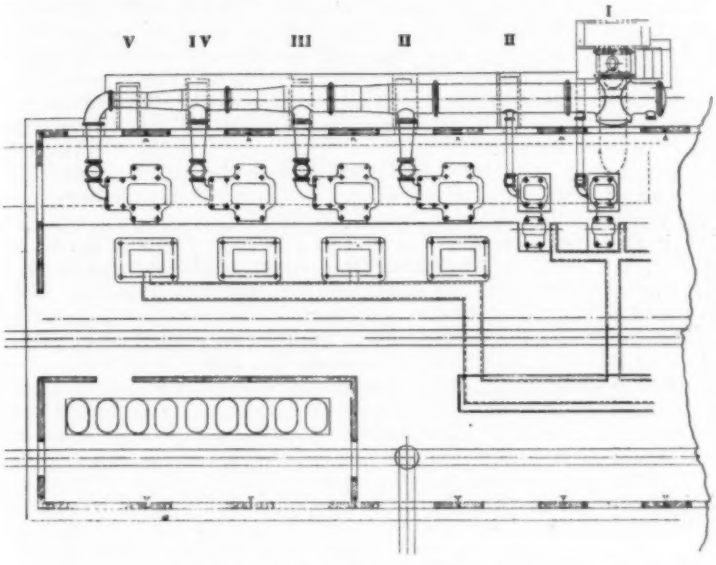


Fig. 4.—Part Plan of Power Station.

The remaining portion of the seven miles of conduit consists of open-cut canal, part of which is masonry-lined; other sections are timber-lined, this being necessary due to the high velocity of flow for ordinary earth. At favourable parts of the total length of conduit, three sand- or settling-basins were built in and form part of the conduit; these basins are located 3,400 ft., 9,570 ft., and 37,150 ft. distant respectively from the intake. This is not the best location, but the topographical features and economy were the deciding factors. On the up-stream side of the two siphons large sluice-gates and an overflow are provided, as also at the first and last sand-basins. On the down-stream side of the last sand-basin the conduit is widened out to a little over twice the normal width for a distance of 75 ft. The average conduit area is 30 sq. ft.

The the point of view of pondage capacity, the topography of the mountain slope did not lend itself to a forebay of the area desired, and use was made of the widening-out of the conduit above mentioned, which was at no great distance above the forebay site. One riveted-steel pipe-line 801 ft. in length, working under a pressure of 148 lb. per sq. in., equivalent to a head of 340 ft., is installed. The thickness of this pipe near the header is 0.72 in., and its inside diameter is 60 in. At the foot of the pipe-line is a header (see fig. 4), which supplies, from five different points, five water-wheels. Also, at the bottom of the 340-ft. fall, before reaching the header, a relief-valve (fig. 3) is installed in the pipe-line; this relief-valve, when actuated, shoots water thus liberated into the wheel-race. Near the relief-valve and before reaching the header, two pipes are taken off the main pipe-line for supply to the water-driven exciters. The header and relief-valves are located outside the generating station building and are without housing (see fig. 3).

The generating station is a steel-structural building. It is 163 ft. in length by 66 ft. in width and 24.5 ft. in height to the bottom point of the steel roof strusses. The station building is of sufficient size to accommodate eight 500-kVA complete sets and three water-driven exciters. The main generating station floor, where the generators are situated, occupies one-half of the building from end to end, this portion being served by a hand-operated travelling crane. The other half of the main generating station is arranged in two floors (see fig. 2). The lower floor is situated on the same level as the generator floor; it is in three sections. The centre section takes in all the low-pressure and the 3,000-volt generator bus-bars, switchboard, and generator and other electrical instruments; in the other two sections all the power transformers are located (see fig. 4). The upper floor contains all the 25,000-volt bus-bars, switches, lightning arresters, and choke coils, space being left for future installations, as in the case of the two sections for power transformers.

At the present time there are five 675-h.p. horizontal-type Pelton wheels, each direct-connected to a 500-kVA, 3,000-volt, 25-cycle, three-phase, star-connected generator running at 300 r.p.m. To each set is connected an hydraulic governor. Massive fly-wheels have been fitted on the main shafts of the generators to aid speed regulation. Load conditions at the receiving station are very severe. The two exciters are driven by Pelton wheels. Each exciter has a capacity of 50 kW at 250 volts, and is capable of exciting all the five generators, which take a total current of approximately 5 x 45 = 225 amperes at full output. Each generator is rated at 97.5 amperes per phase, but at the present time common practice is to run them at 110 or even 125 amperes per phase for many hours continuously. As the power factor at the generating station is generally low (about 0.78), due entirely to the inductive load at the receiving end of the 25,000-volt transmission line, and as the generators are unduly heated by the resulting ampere load, one of the generators is usually run as a synchronous condenser. Instead of giving 120 amperes per phase, each generator now gives about 100 amperes per phase for equal kW output; in other words,

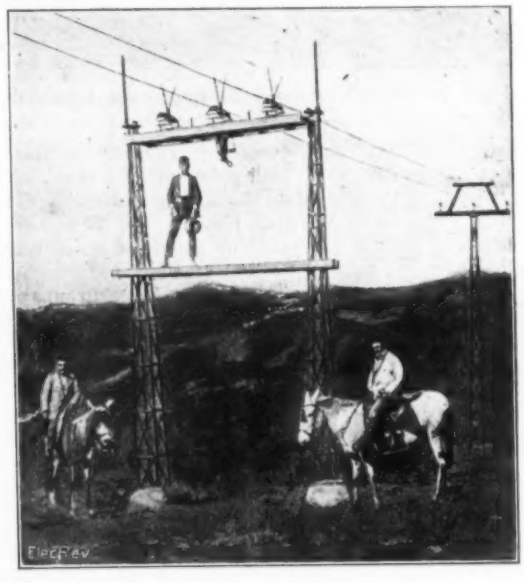


Fig. 5.—25,000-volt Transmission Line, showing Sectionalising Switch and Method of Supporting the Earth Wires.

the output of each machine has been increased by making use of an idle generator, the operation being simply that of running the set up to speed, synchronising it, giving it full exciting current, then turning the water off the wheel. Obviously this would have a much better effect on the system as a whole were it installed at the receiving end, a distance of 50 miles. The load factor of the system throughout the year is slightly over 70 per cent.

From the bus-bars, behind the switchboard, three main leads are carried to the second floor of the generating station, where the low-pressure bus-bars of the power transformers are located. At the present time there are ten 200-kVA, 14,250-volt, single-phase transformers arranged in three groups and connected in delta on the 3,000-volt side, the high-pressure windings having their phase-windings connected in star to give 25,000 volts between phases. One transformer is a spare; the transformer wiring and its switching are so arranged that this spare unit can, almost instantly, be connected on to any phase of the system. Each power transformer is oil-insulated and water-cooled by means of an internal cooling-coil. External cooling is also arranged for. A device is placed around, and near, the top of the boiler-plate transformer tank or casing, and water is fed through openings so that it flows over the entire outer surface of the tank down into a water-race at the foot of each tank. This additional and external method of cooling is found to be quite efficient; it is a cheap and entirely reliable addition to the internal cooling-coil arrangement, and aids materially in drawing heavy intermittent overloads from the transformers with safe temperature rise.

Triple-pole air-break switches are employed throughout, *i.e.*, for the generators, the transformers, and the 25,000-volt busbars and outgoing transmission lines. The generators are fused with glass-enclosed fuses, and the transformers are fused on the high-pressure side with the ordinary open-fuse. Each phase of the 25,000-volt switches and fuses is separated by means of a non-combustible barrier, and at the top of these barriers are located the busbars which tie-in the three groups of transformers to the transmission line through one air-break switch and three choke-coils.

Fig. 6.—Section House for Patrol Men.

Because of the very severe lightning storms that prevail in these regions, several types of lightning arresters have been installed. Some experimental work in this direction was carried on, leading to the conclusion that the most troublesome type of lightning arrester is the horn-gap with oil-immersed resistance in the earth circuit. The water-jet arrester fitted with the glass tube gives better service than the water jet not fitted with a tube; with this type of lightning arrester care is necessary to regulate properly for the percentage excess operating voltage. The multi-gap (shunt) carbon-resistance type of lightning arrester is also used. The most reliable of the three types is the water-jet with glass-tube discharge-passage. The country through which the transmission line extends is very mountainous and rugged. Expansive outcrops of iron-bearing minerals are exposed along the route, and serve to attract lightning. The lowest point of elevation of the transmission line is about 12,500 ft., and the maximum about 14,600 ft. above sea level. Between the months of November and February very severe wind and lightning storms roll over the mountains, and frequently cause interruptions by the puncturing of insulators, transformers, and sometimes lightning arrester burn-outs. The nature of the country is such as to make it a difficult matter for linemen to patrol the lines properly; after dark it is practically impossible to do so, because of the danger of falling over a precipice. During the lightning season of each year the most frequent troubles are due to insulator failures.

Two earth-return telephone lines traverse the whole transmission-line route. These telephone lines are so arranged that either one metallic circuit or two earth-return circuits can be operated. Telephone switching arrangements are made at each of the patrol houses, at the main receiving station, and at the generating station.

The patrol houses are located where the sectionalising switches are installed. All the shorter sections are located in the most difficult and inaccessible regions. The common class of patrol house is shown in fig. 6.

The transmission line consists of one three-phase circuit with the conductors arranged throughout the fifty miles of line in a horizontal plane on one cross-arm. The conductors are of hard-drawn copper, solid wire; each wire is approximately No. 3/0 S.W.G. size. The line conductors are given a one-third turn at three different parts of the entire transmission length, or one complete transposition. The insulators are of green glass, and are mounted on wooden cross-arms by means of wooden pins each spaced 2.75 ft. apart on the same cross-arm, the two outer conductors being 5.5 ft. apart. The poles are of steel lattice-work construction, are 32 ft. long, and are spaced at an average of about 125 ft. apart on straight runs; the distance between poles is slightly less on irregular ground. There are no very long spans in the transmission line. The line is daily patrolled on mule-back, as horses cannot work at that altitude. The patrol-men are Bolivians.

The transmission line has an overhead earth-wire for protection purposes, as will be seen from fig. 5. One of the line sectionalising-switches is shown. On each side of the line will be seen a metal upright support which holds the galvanised-iron earth-wire above and on either side of the main transmission line wires. The pole seen in the background (fig. 5) shows the regular support used throughout the transmission line for supporting the two earth-wires, which are connected by means of wires to the steel lattice-poles. Certain sections of the transmission line have wooden supports, while others are provided with two iron rods and an iron cross-rod which connect the earth-wires to the metal pole.

The receiving station is of steel structural construction, and is located at an elevation of 13,624 ft. above sea level. A part of the receiving station is designed to accommodate an auxiliary steam plant. This auxiliary plant consists of six 200-h.p. boilers of the horizontal type, a compound Corliss type engine of 1,000 h.p. capacity, and a direct-connected 650-kVA, 3,000-volt, 25-cycle, three-phase revolving-field type generator. The high-pressure equipment, and the power transformers, are an exact duplicate of those in the generating station 50 miles away. There are three exciters, two motor-driven and another driven by means of a marine type steam engine. The sub-station also contains a 3,000/550-volt motor-generator set for electric traction purposes. At a point about 4.5 miles distant from the main sub-station a 3,000-volt three-phase line feeds a sub-station supplying current to a motor-generator set, which latter is tied-in on the 550-volt generator side, with the electric traction service fed by

the main sub-station. Six electric locomotives are at present in operation for both underground and surface electric traction service.

Another interesting part of the installation is the pumping in large quantity (nearly 9,000 cu. yd. per day) at a great depth (1,775 ft.) of natural boiling water containing dangerous acids. One 650-h.p. motor-driven pump lifts water at approximately 55 deg. C. a vertical distance of 1,475 ft. The pumping difficulties encountered due to the high altitude, the destructive acids, and dangerous gases, called for special materials and special pump designs and all manner of means of signalling, &c. The greater part of the underground workings are operating continuously at a temperature ranging between 42 deg. C. and 50 deg. C., in the rooms where the 3,000-volt motors are working. Several of the underground motors are fed from transformer stations located underground. The 3,000-volt switch-boards, instruments, &c., are also located underground. The larger underground electric equipment installed includes the following items:—

Electric Hoists (Underground).

"Pulviner" hoist	...	...	125 h.p. motor
"San Leon" hoist	...	...	125 ,, ,,
"Pero" hoist	...	...	125 ,, ,,
"Beta" hoist	...	...	50 ,, ,,
"Alpha" hoist	...	...	50 ,, ,,

Electric Pumps.

Located at a vertical depth of		1,775 ft.;	two	250-h.p.	motors
,,	,, ,,	1,475 ft.;	one	620 ,,	,,
,,	,, ,,	1,475 ft.;	one	300 ,,	,,
,,	,, ,,	1,475 ft.;	two	250 ,,	,,
,,	,, ,,	1,375 ft.;	one	250 ,,	,,
,,	,, ,,	1,375 ft.;	one	50 ,,	,,
,,	,, ,,	1,275 ft.;	one	250 ,,	,,
,,	,, ,,	1,275 ft.;	one	35 ,,	,,
,,	,, ,,	1,150 ft.;	two	450 ,,	,,
,,	,, ,,	1,150 ft.;	four	250 ,,	,,

Electric Ventilators.

Located at a vertical depth of	1,375 ft.,	100-h.p.	motor
,, ,, ,,	1,150 ft.,	50-h.p.	,,
,, ,, ,,	(various)	50-h.p.	,,

Electric Compressor.

Located at a vertical depth of 1,150 ft., 220-h.p. motor.

The total motor capacity installed underground is 4,325 h.p.

On the surface (not underground) important works are installed, such as exceptionally large machine shops and workshops capable of handling very large castings; iron and brass foundries; concentration plant; electrolytic plant; extraction and refining plant; and a 200-h.p. synchronous-motor-driven compressor which, when idle (not mechanically loaded), is floated on the system as a synchronous condenser.

The author was the chief technical director, with the title of Injeniero Jefe Superior del Servicio Electrico y Tallers.

ELECTRIC VEHICLES IN THE UNITED STATES.*

The Present Situation.

The electric vehicle has become an economic factor in the business life of America. When the high cost of haulage and delivery in large cities is analysed, it becomes more readily observable that the most conservative business organisations, to which reliable transport at the lowest cost is of vital importance, are consistent users of electric vehicles. As one of many examples that could be given, the American Railway Express Co. may be cited. It was in June, 1908, that the firm bought its first electric vehicle; a few weeks ago it enlarged its fleet by the purchase of 105 more. The company operates now 1,426 vehicles, and its sole business is transportation. In addition to the repeat orders which prove the satisfaction and economy that have resulted from the initial orders placed years ago, it should at least be of interest to know that there are electric vehicles in continuous daily service, 12, 18, 20, and even 24 years old; there are about 1,000 in New York City which have been 11 years in service.

Why this type of vehicle possesses so long a life is easily explained by its simple, robust construction; its speed, while adequate for city traffic, is not a contributing factor to large maintenance and repair expenses; lower insurance rates; no energy consumption when standing idle; extremely low depreciation; longer life of tires; the most economical and cheap form of power (it is said that the tire cost of a light electric truck is less than that of keeping a single horse in shoes, and that electricity costs less than food for a single horse doing the same work) are a few of the many features of the electric truck that make the cost per mile, ton-mile, or ton hauled the lowest of any known method of transport.

Of late years several manufacturers have invested large sums of money in modern plant equipped with the latest machinery and facilities to manufacture electric vehicles in every way equal in detail of construction to any internal-combustion engined car of corresponding size. It must be remembered that the entire industry has been created within a single generation—a short period of time for a development of this magnitude. With such a display of testimony as is readily available from those in a position to express intelligent and unbiased opinions on the subject, it would be impossible to account for the relatively small number of electric vehicles now in use, were it not that equally unbiased and spontaneous opinions can be obtained from others who have tried such vehicles and failed to get satisfactory service from them. The question, therefore, presents itself: Why do some users obtain good service while others do not? The answer is that some vehicles are operated under unfavourable conditions and by operators who not only do not know anything about electric vehicles, but who are making no effort to learn anything, because they have been told that there is nothing to learn. The popular fiction that a child can operate an electric vehicle has been a fixed part of the creed of salesmen too long. There is no mysterious virtue in an electric vehicle by which it will continue to give good service when its operation is left entirely to someone who never had an opportunity of learning anything about electrical apparatus.

The first attempt to provide technical training of any kind for electric vehicle operators was made a little over a year ago by Prof. E. G. Cooley, of the Continuation Schools of Chicago, who had the co-operation of the Commonwealth Edison Co. and the local electric-vehicle industry. By operators are meant those who are responsible for keeping the vehicles in proper working order, not the drivers.

The school, which is the only one of the kind as far as we know, is in charge of Mr. John Crowell, as head master, and has a complete equipment of all the apparatus and instruments necessary for a technical course of this kind, as well as a modern machine shop, in the charge of an instructor, which is open to students taking the course. Several classes have already been conducted with an average attendance of about a dozen in each class. The development of the electric-vehicle industry will bring about an increased demand for competent operators, and competent operators will in turn create a demand for more electric vehicles.

Reliability is one of the chief essentials in fire-fight-

*Based on articles appearing in the *General Electric Review*, April, 1922.

ing appliances, and the use of electric propulsion for this class of service, as illustrated in fig. 1, is a tribute to the perfection that the electric vehicle has attained. An idea of the modern passenger vehicle is conveyed by fig. 2 (Rauch & Lang, Inc.), while fig. 3, which shows the supplementing of haulage with power for miscellaneous purposes, illustrates the usefulness of electric vehicles. Fig. 4 is a view of 41 delivery wagons in laundry service (Ward Motor Vehicle Co.), and serves

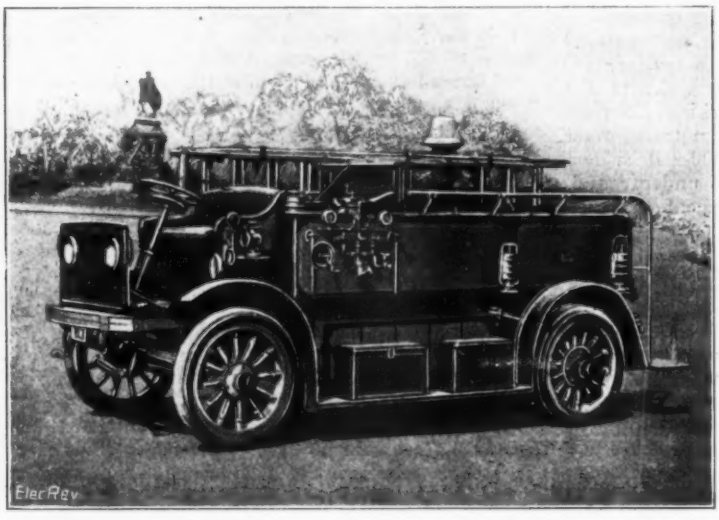


Fig. 1.—An Electric Fire Engine.

the purpose of indicating the size of fleets of "electrics" in use in the United States.

Progress in accumulator development has played an important part in establishing the electric vehicle on its present economic basis. It is customary to use the maximum number of cells, consistent with the charging source; the nominal 110-volt d.c. source calls for 40 or 42 lead-acid cells, or 60 nickel-iron-alkali cells. With the increase of the output up to 10½ watt-hours per lb., the practical limit of capacity for the lead battery seems (says Mr. Bruce Ford) to have been reached, and even then at some sacrifice of life compared to the previous thicker and more rugged plates. The Exide-Ironclad positive plate gives about 9⅔ watt-hours per lb. of cell and two or three times as long a life as any of the previous pasted plates. The nickel-iron battery gives about 14 watt-hours per lb. of cell; the capacity per unit of space, however, is slightly lower than that of the lead battery. Each type has some advantages over the other.

The development of battery-charging equipment, refinements in motor design, the number of new electric garages, and the realisation of the value of the electric vehicle by electricity supply authorities, who have not only advertised, but have made available their showrooms for free public exhibitions, have established the permanence of the electric vehicle.

Concerning battery-charging systems, in some cities enterprising generating station authorities have arranged to transfer fully-charged batteries of standard construction. This plan should receive further attention. Another method is the sale of the vehicle without a battery, the latter being considered a separate unit for which a definite rental charge is made; the amount, of course, must be sufficient to pay the interest on the cost of the battery, its maintenance, and a reasonable profit. This plan has been in operation at Hartford, Conn., since 1912, and is being given serious consideration by battery manufacturers. It appears that its introduction would add greatly to the success of the electric vehicle and cause a much more rapid growth than in the past.

Time is a very important factor in commercial establishments; therefore, the systems used must be capable of charging the battery in the proper length of time to make the vehicle available for whatever work it has to perform. Systems are in use that will charge batteries in as short a time as 3½ hours, but the first cost of charging equipment is very nearly in inverse proportion to the time that is available for charging. "In general, any charging rate is permissible which does not produce excessive gassing, or a cell temperature exceeding 110 deg. F." The three methods of charging, in the order in which they came into use, are as follows:—

(1) The series-resistance, or constant-current method is still used where an attendant is available, or when other methods might be impracticable.

(2) The constant-potential method was adopted in several garages a few years ago and gave good results, but it has disadvantages.

(3) The modified constant-potential method is a combination of the two foregoing methods, and is fast gaining popularity.

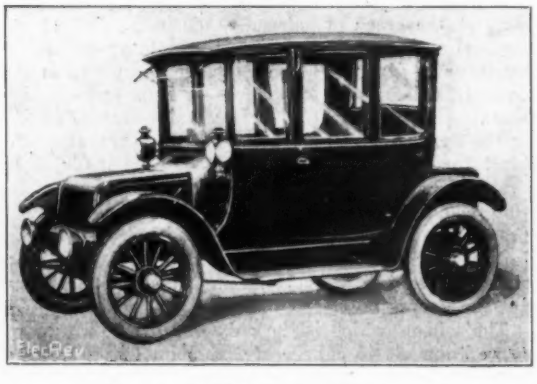


Fig. 2.—A 1922 Electric Sedan.

Fig. 3.—A Useful Electric Wagon.

The principal advantage of system (1) is its flexibility; different sizes of battery can be charged at different times from the same circuit—a useful feature from the public garage point of view. Its principal disadvantages are: Charging results uncertain, due to having to rely on the attention of the operator; it costs more to install, and involves a longer time for charging.

The advantage of method (2) lies in the possibility of charging in about 15 per cent. less time than the quickest combination of system (3), and at the same time there is little likelihood of damaging the battery. Its disadvantages are that, if few batteries are to be charged, the charging apparatus must be very large, due to the high starting rate (from 100 to 150 amps. per battery). If a large number is to be dealt with from the same bus-bars, it is possible to start one battery at a time and wait from 15 to 30 minutes before putting the next battery in circuit. Any slight variations in the bus-bar pressure cause great fluctuations in the charging rates which may be harmful to the battery; furthermore, all the batteries must contain the same number of cells, if they are to be charged from one bus-bar. But it must be mentioned that many users are satisfied with the system.

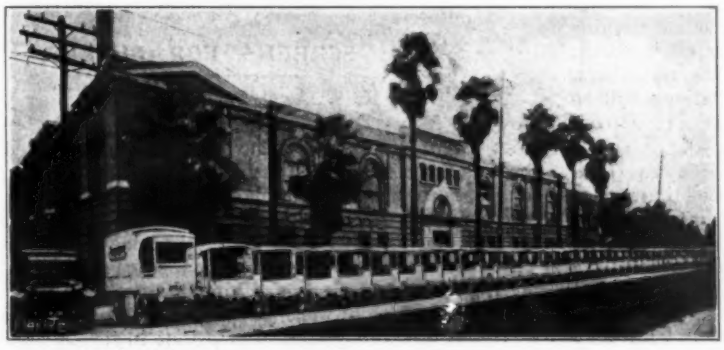


Fig. 4.—A Fleet of 41 Vehicles.

Method (3) is similar to (2), the only difference being the addition of a fixed resistance to cushion the shocks that result from the heavy inrush of current at the start. There is no doubt that this is the system of the future.

Regardless of the method of charging, or the type of battery charged, a device for disconnecting the battery when the charge has been completed is almost essential, and is used in nearly all modern installations. The most practical device is a combined ampere-hour meter and electromagnetic trip for breaking the charging circuit when the meter pointer reaches the full-charge point. The meter is preferably mounted on the vehicle.

When the source of supply is a.c., the mercury-arc is used in the home garage for charging the electric passenger-car on account of its simplicity; the motor-generator set for a single vehicle is also being used to a large extent. When the source of supply is d.c., a rheostat can be used, but if the number of cells is less than 30 it is more economical to use a motor-generator, and, in any case, the charging characteristics are likely to be better than when a resistance is used. When charging batteries for a fleet of vehicles a switchboard is, of course, needed.

Three general methods of motor application are in use, namely: (*a*) either two or four motors are mounted on the axle, and the power is communicated to either two or four wheels through a system of annular and spur gearing operating in oil; (*b*) the motor is mounted on the chassis and drives a live rear axle through a worm or spiral bevel gear; (*c*) the motor is mounted on the chassis, and the power is transmitted through a bevel gear to shafts that are, in turn, geared through pinions and annular gears to the rear wheels. To provide a machine that can be adapted to any of the above forms of transmission, the General Electric Co., of Schenectady, N.Y., has developed a motor, fig. 5, of which the magnet frame and commutator-end bearing head are one-piece castings, machined from end to end. The armature is mounted on ball bearings, and the bearing heads at both commutator and pinion ends are enclosed, so that the motor is thoroughly protected from moisture.

The motors are all of the two-brush stud, four-pole construction, and both the fields and armature are wound with rectangular wire; the result is a motor of low tooth density, high torque ratios, and liberal overload capacities. The machines are designed to operate totally enclosed continuously on normal load with a 65-deg. rise above 25 deg. C. ambient air, and for one hour on 200 per cent. load with a maximum of 75 deg. C. rise. The average brush density on normal load is 25 amp. per sq. in., and a copper-graphite brush is used when the machine is to operate at 60 volts or less. A second type of motor is constructed with a magnet frame made from a steel plate (in which handholes are punched) pressed into cylindrical form and welded, and in a final operation forced through a sizing die. This type of frame contains much less material than a casting, in which a liberal allowance has to be made to cover wastage in finishing. For passenger-cars the motor torque ratio can be approximately 4 to 1; for commercial vehicles it should be as high as possible.

It is often necessary and advisable for the same concern to use both petrol-driven and electric wagons, each type in its particular field. Users of such a mixed fleet find that it is a very difficult matter to train mechanics to "service" the different vehicles properly, and that the problem is greatly simplified by standardising a limited number of the different types of machines. The advantages of interchangeability of parts (so far as is possible) are so favourable that it is surprising that the idea has not been carried out to a greater extent.

Concerning the electrically-driven pleasure vehicle, the following figures represent average values.

Present-day batteries have a life varying in car-miles from 10,000 to 20,000, depending on their excellence. The cost of their renewal varies from two to three cents per mile. Tires show an average renewal cost of 1 cent per mile, which represents a mileage of from 12,000 to 18,000 miles, figures which at first thought may seem high, but are easily explained by the fact that electric pleasure cars are only operated at moderate speeds and for the most part are driven on well-paved streets and roads. Service records show that the total cost of repairs, oiling, &c., varies from three-tenths to one-half of a cent per mile. With electric energy at five cents per kilowatt-hour it costs about 80 cents to fully charge a battery capable of supplying sufficient energy for 60 miles of travel. This represents a cost of one and three-tenths cents per mile.

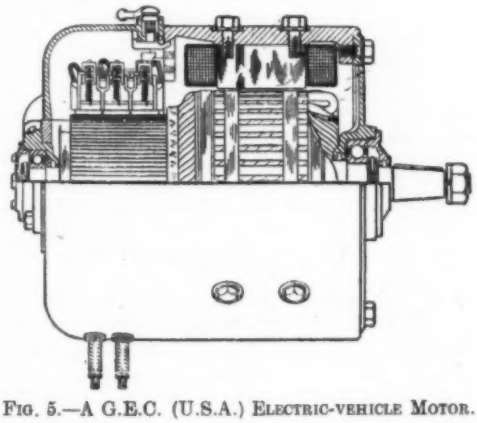


Fig. 5.—A G.E.C. (U.S.A.) Electric-vehicle Motor.

Summing up, the total operating expenses of an electric passenger car will not be far from 5 to 5½ cents per mile. As nearly as can be determined, the direct operating cost of an electric passenger car is about 60 per cent. of that of a gasoline car of equal

excellence and accommodations. When all other items, such as insurance, depreciation, &c., all of which favour the "electric," are considered, the total cost to own and operate an electric car, as compared with a similar gasoline car, will approach a ratio of one-half.

It will seem somewhat of a paradox that an article of such undoubted economic merit still continues to be in minority use. The cause of this, experience has proved, is psychological, and not due to any lack of merit, mechanical or electrical, on the part of the "electric." The average person is so thrilled by speed and sensational performance that these overshadow all other considerations. The time is not far distant, however, when the shrewd man will consider the purchase of an automobile on the same basis that he does any other machine which he uses to carry on his business. In other words, its ability to meet his requirements—its reliability, economy, and cost of ownership and operation—will be the guiding factors. When passenger cars are selected scientifically, more "electrics" will be used.

Within the past ten years the situation has been vastly improved. As the appreciation of the limitations as well as the possibilities of the electric vehicle has slowly been demonstrated and disseminated, and its costs and selling prices reduced, public garages have been built for the accommodation of fleets as well as for single vehicles, and portable or semi-portable garages placed upon the market which, equipped with very reliable but comparatively inexpensive and simple charging apparatus, have afforded relief in this direction, so that the problem of housing and caring for the electric vehicle has been greatly simplified and cheapened.

Meanwhile, experience has shown with adequate exactness the field within which electric vehicles may be profitably employed, and while it is quite possible to design and equip an "electric" with a speed range equal to that of a corresponding internal-combustion engined vehicle, such vehicles are commercially impracticable due to mileage limitations, and the field for touring and speed vehicles is by common consent left to the makers of petrol cars. On the contrary, where the normal speed required is not in excess of 20 or 25 miles an hour, the radius of travel not exceeding 60 miles per charge, and there is necessity for frequent stopping and starting, the electric vehicle finds its legitimate and proper place. Within this field it possesses a great many advantages. Generally speaking, the "electric" can be operated at from 25 to 30 per cent. less cost than the corresponding petrol car. Its mechanism and construction are far simpler; it is less liable to derangement; there is little, if any, fire risk attendant upon its use. Inspection, oiling, and cleaning are more easily and cheaply accomplished; it is particularly dependable under adverse weather conditions. Altogether it requires much less attention and entails much less cost in upkeep and maintenance. There are at present between 9,300 and 9,600 commercial vehicles, between 19,500 and 20,000 passenger vehicles, from 2,300 to 2,400 battery locomotives, and from 8,300 to 8,500 industrial trucks in use in the United States.

For charging these 29,000 odd road vehicles alone, some 80 to 85 million kilowatt-hours of electricity is required annually, in itself no mean revenue-producing load for the central stations of the country.

As a pleasure vehicle for smooth, noiseless, and luxurious riding the "electric" has no equal; as a commercial vehicle within its proper field it is thoroughly reliable and dependable. The horse is too slow, insanitary, short-lived, limited in capacity and endurance. Dr. J. A. Harriss, Special Deputy Police Commissioner of New York City, in charge of traffic, urges immediate legislation to abolish the use of horses in Manhattan by 1925. There is to-day in the U.S.A. one motor-car for every twelve persons, and more than nine times as many passenger cars as motor trucks. The supply of petrol and fuel oil is fixed, and we are drawing at an ever-increasing rate upon Nature's stores of these fuels. On the contrary, electricity can be secured as long as water flows and fuel burns. The future of the electric car within its legitimate field, with regard to dependability, simplicity, ease of handling, long life, and low cost of maintenance and operation, is assured by its demonstrated superiority.

It has won its recognised place in performing a constantly increasing share of the world's work. It does not assert its applicability to all services, but it does assert and is ever ready to prove its superiority to any other known means of transportation in the wide and important fields to which it is properly applicable.

SMOKE SCREENS FOR BUYERS.

By W. A. C. PHILLPOT.

The recent controversy regarding the endeavours of a buyer to protect himself from the assaults of the army of salesmen who are making such desperate efforts to overcome the effects of slump on their own particular interests by an intensified use of the honeyed word and grinning countenance (known as salesmanship), has at least had the effect of giving the general electrical public some idea of what a buyer has to contend with.

It was also interesting to note that in the case of the courteously-worded notice which raised the question of the desirability of seeing travellers at all times, the cudgels were *not* taken up by an electrical salesman (for prudential reasons perhaps), but by an outsider on behalf of his brothers in our trade.

Messrs. Simplex, being naturally wicked, no doubt, defend themselves vigorously when attacked, but, curiously enough, both parties ignore—not because they are unaware of it, I am sure—the fact that the real sting, the concealed caustic, of the notice lies in these two phrases: "Cut out small talk" and "Please be brief."

Now, to tell a traveller that any of his talk is small is to plunge poisoned darts into his most vital organ—his mouth-organ; to request him to be brief is to ask him to abstain from further use of the respiratory process. Like two into one—he can't.

Travellers' small talk, as this buyer so unkindly calls it, is as necessary to their existence as oxygen, and in the course of long waits for interviews they even practise on one another, as any commissionaire will tell you. (It is done to keep the jaws supple.) But how can a traveller show his selling ability if he must not small talk (or talk small) and must be brief? How can he bring his knowledge of psychology to bear on the buyer if you do not give him time to pronounce the word? The buyers know the answer to this, by the way, but dare not give it for the sake of those at home.

As a matter of fact, electrical travellers have less to grumble at in this respect than those in other trades. Among the wholesale chemists you sometimes come across a waiting room with a first- and a second-class pigeon-hole—only they are labelled "General" (or "Inquiries") and "Travellers" respectively. In others, neatly painted up, appears the inscription "Travellers. Mondays and Thursdays, 10 to 12." "Terse" is one of the things I have heard it called.

I don't think either of these pretty customs has reached the electrical trade yet. Neither, I must admit, has an even prettier one—rather rare even among the chemists—of having a separate waiting-room (complete with chairs) open *at all times* for travellers, or I have never had the luck to see it.

The reason—so Good Buyers say—for seeing all travellers at all times is that by not doing so you *may* miss a good proposition. (I admit the odds as being anything you like to a fraction against, at present.) The man with a good proposition may call on the wrong day—and take it to someone else's right day—and so you lose it.

The Good Buyer, too, will make much of the Bad Traveller, greeting him with nods and becks and

wreathed smiles and a cigarette and a chair in front of the radiator.

The Good Traveller is not so often the one with a good proposition, and so does not need this encouragement, but rather the icy word, the fishy hand, and the cold corridor. The Good Traveller, if he is an artist—and he always is in one direction, at any rate—is, I sometimes think, rather hampered by the good proposition. He knows he knows all the arts of salesmanship, and it is possible that he prefers something that will enable him to display his powers—and his personality: dud stuff, in fact. If he is capable of supplying Diabolus with fur-lined overalls for working hours, why should his cab-tire flex be a penny a yard, or his I. W. blocks a shilling a gross cheaper than those of his competitors? And if he sees a notice-board that tells him (by implication) that he is not welcome just now, he will come again and sell with redoubled violence.

The Bad Traveller—who calls at the right time—knowing nothing of the art of selling, will endeavour to obtain your order by the superiority of his goods and the inferiority of his prices. The Good Buyer knows this, but he has never (until now) presented his knowledge to the world.

An ingenious method cultivated among the fraternity is the use of a dummy ear with which to listen to salesmanship and talking points, in conjunction with a microphone ear with which information as to prices, terms, delivery times, &c., can be obtained. We cannot all, however, contrive this—cotton-wool plugs have been found unreliable—and it is this disability which has led to the use of the notice-board and the conversational current limiter.

A certain Good Buyer of my acquaintance (it was me) inherited such a notice-board—an ultra-polite one, too—from his predecessor, an Excellent Buyer, whose one weakness it was, and enjoyed complete bliss on Tuesdays, Thursdays, and Saturdays. However, an assertive, overfed conscience soon began to nag me (I mean him) on the subject of these halcyon days.

"Suppose," it said, "the case of a man with something really good coming up from the provinces for the day on a Tuesday. Will he, after seeing your board, spend a night in London?"

The G. B. supposed it, and thought of scrapping the board. He decided to find out first, though, what the travellers really thought of it, and managed to get the candid opinion of an old hand. It is to be regretted that this candid opinion can only be communicated verbally.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Post Stylolectric" Pen.

Industrial Engineering, Ltd., Poland House, 167, Oxford Street, W.1, is demonstrating at Messrs. Selfridge's a new type of marking pen recently put on the market by a New York firm. This is the "Post Stylolectric" pen (fig. 1), a simple electrically-heated appliance, by means of which marks can be

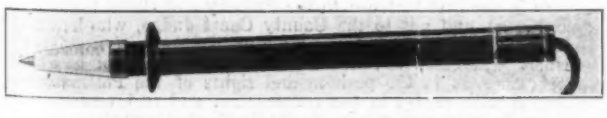


Fig. 1.—The "Post Stylolectric" Pen.

"scorched" into almost any substance. In order to obtain the required degree of heat, the pen is placed in series with an electric light bulb of the necessary size. This is effected by means of a special series plug which can be attached to a lamp-holder. Four different points are supplied for various purposes. The pen can be used for marking, re-touching blueprints or photographs, for small soldering applications, for cautery, and it has numerous other uses.

The "Minirisk" Burglar Alarm System.

Some time ago we commented rather facetiously, but not altogether unjustly, upon a lay contemporary's description of a burglar alarm system, which was made to appear both miraculous and absurd at once. Having inspected the "Minirisk" system, which was the one referred to, we can now say that, although the description was exaggerated, the methods employed possess ingenuity and novelty. The principle of the "Minirisk" system is an adaptation of the Wheatstone bridge, *i.e.*, the alarm is operated by the upsetting of balanced resistances. Two adjacent arms of the bridge consist of equal resistances; the third arm is formed by an adjustable resistance; while the fourth arm is the exterior alarm circuit. A 4-V battery supplies energy to the bridge, parallel paths being formed respectively by (1) a fixed resistance and the adjustable resistance; and (2) the other fixed resistance and the exterior circuit. A balanced relay is connected across the two arms. The composition of what we have called the "exterior circuit" must be explained. In this all the points or objects which it is desired to protect are

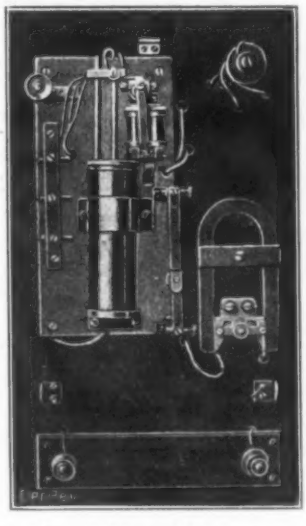


Fig. 2.—The "Minirisk" Burglar Alarm.

in series. The methods of protection are various, and a few examples are given. Panelling may be guarded by a length of very thin wire so distributed over each panel that an attempt to break or cut through must sever the wire. Vases and similar *objets d'art* may be placed on a spring contact which is released to break the circuit when the article is lifted. A similar spring catch may be fitted in the bottom of a window frame so that it is held down while the window is closed, and released when the window is opened; a closed desk may be similarly protected. The backs of valuable paintings may be covered with a composition paper consisting of two sheets of tinfoil separated by paper insulation, so that the two tinfoil sheets are bridged when pierced by a knife or stiletto. As it would be quite easy for a burglar who might possess a knowledge of the system to bridge across the wires before removing an article or entering a room, compact resistances of two or three hundred ohms may be employed at each point; these also add to the efficiency of the system. The method of operation can be gathered from the foregoing information. When interruption is made at any point the bridge arrangement is unbalanced, a current is sent through the relay, and the needle of this swings to either side and completes an alarm bell circuit by releasing a catch retaining a plunger in an oil-filled cylinder. The plunger makes contact with three points at regular intervals, and in some installations bombs have been employed in conjunction with this. In banks or post offices, where it is desired to guard against "hold-ups," a wire with one end fixed loosely in a socket may be employed. This is installed behind the counter, a short distance from the floor, and can be readily disconnected by a movement of the foot.

The illustration (fig. 2) shows the case containing the fixed and adjustable resistances, the relay, and the plunger. This is ordinarily enclosed in an iron cover, which itself forms part of the protective circuit.

The system, which we have seen satisfactorily working, is being handled by Messrs. Drake & Gorham, Ltd., 36, Grosvenor Gardens, S.W.1.

A New Lamp-colouring Varnish.

The new "Alpha-Supra" varnish for colouring electric lamp bulbs will be of interest to all users of coloured lamps, inasmuch as its application and removal are extremely simple operations. It is a product of the London Dye Manufacturing Co., Ltd., and is manufactured at its City Mills, 86 to 94, High Street, Stratford, London, E.15. It is in the form of

a liquid that is obtainable in a variety of colours, and all that is necessary to colour the lamps is to dip them into the varnish and allow them to drain and dry for a few minutes. The film of varnish that adheres to the glass is very thin and cannot be washed, scraped, or peeled off, and it is said to withstand the effects of the weather; in fact, it is very difficult to remove it except by means of the solvent which the makers supply for the purpose.

When applying the varnish no heat is required, as it will dry in from 10 to 15 minutes, and no experience is required, either for its application or removal.

Apparatus for Re-energising "Ford" Magneto Magnets.

Those of our readers who own "Ford" cars will be aware of the fact that the magnets of the magnetos fitted to these machines require attention from time to time, and often very frequently. A number of methods are employed to restore magneto efficiency, the usual way being to apply an electro-magnet for a series of short periods to the magneto magnets. This invariably involves the taking-down of the magneto. The principal feature of the "Wonder" magneto "re-charger" is its ability to perform the operation while the magneto remains in position on the car. The method employed consists in connecting one lead to the terminal post and another to earth and giving a number of shocks of four seconds' duration with a current of about 26 A at 15 or 16 V. We recently inspected the apparatus at the Hammersmith depôt of International Motors, Ltd., which is adopting the device as a part of its service system. In this case the re-charger was operating upon a 110-V, 60-cycle, single-phase circuit, and the current was converted to d.c. by means of chemical rectifiers consisting of lead and aluminium plates in an acid solution. These, with a snap switch on the a.c. side and an ammeter on the d.c. side, were contained in a case measuring 24 in. x 18 in. x 6 in. A twin cable was plugged into circuit and taken to the magneto, and the exhaust pipe of a "Ford" car. The application of energy four or five times appeared to increase the ignition efficiency to a great extent. The inventor, Mr. David Forrest, informs us that the chemical cells would also be employed upon a d.c. supply, acting as resistances. He also states that a large number of these re-chargers are at present in use in Canada, and he possesses testimonials from several firms.

The device is being handled by the Wonder Recharger Co. of Great Britain, 7, Camberwell Green, S.E.5.

LEGAL.

Electro-Metals, Ltd., *v.* Malleable Steel Castings Co. (1909), Ltd.

The hearing was resumed on May 2nd, before Mr. Justice Sankey, of the action, the hearing of which was begun in February, in which the plaintiffs sued the defendants, of Scotia Works, Pendleton, Manchester, to recover £1,239 in respect of the balance of purchase price of a 30-cwt. electric smelting furnace sold to the defendants under an order of May 10th, 1918. The defendants' case was that the plant was unsatisfactory, and they set up various warranties that they alleged the plaintiffs failed to comply with, and they counterclaimed for loss suffered by the alleged deficiencies of the plant, which, it appeared, was installed at the defendants' works. Mr. T. W. H. Inskip, K.C., and Mr. Wilfred Lewis were for the plaintiffs, and Mr. T. Eastham, K.C., and Mr. R. Bennett represented the defendants.

A considerable body of evidence had been given at the previous hearings, reported in the Electrical Review for February 17th and 24th, and the only witness now remaining was Mr. Edward A. Walsh, director and works manager of defendants, whose evidence had been taken before an examiner. In his evidence Mr. Walsh referred to the giving of the alleged warranties, and said that they were never able to run the furnace successfully as a commercial proposition; it never produced steel suitable for steel castings, nor did it produce steel using 800 units per ton in the ladle.

Replying to Mr. Eastham, Mr. Walsh said he was present at the interview between Mr. Bibby, of the plaintiff company, and his father, Mr. Walsh, at the works at Salford on February 17th, 1918. They all went over the works.

At the close of the evidence, Mr. Eastham argued that the defendants' case was established that the furnace was unsatisfactory and, as one of the witnesses had said, was "a bunch of trouble from start to finish." He contended the warranty was that it should produce 40 tons tensile steel with 15 per cent. elongation, the steel to be produced to the defendants' satisfaction, with the ordinary process of annealing. This was the sort of guarantee that the plaintiffs were in the habit of giving, and it was not a fancy guarantee. He asked the Court to say that the contract was broken with regard to the warranty as to electricity; the defendants' counterclaim was for £3,182 plus such sum as the Court might consider fair with regard to the liability of the defendants to the Salford Corporation under an agreement as to the supply of electricity.

For the plaintiffs, Mr. Inskip, K.C., argued that the furnace was capable of running at about 800 units continuously, and that the representation was that this was the average consumption for such a furnace. The only representation was that the furnace would be capable of producing steel to the defendants' satisfaction, and there never was any guarantee given as to 40 tons tensile strength and 15 per cent. elongation.

In giving judgment, Mr. Justice Sankey said it was alleged that the plaintiffs warranted that this furnace would produce steel of a tensile strength of 40 tons to the square inch and 15 per cent. elongation unannealed, but on the whole he could not conclude that any such warranty was given. The making of steel castings was expert work, and he did not think that Mr. Walsh had adequate knowledge of these matters. He thought there was a guarantee that the consumption of electricity would be about 800 to 850 units for continuous working, but he was of opinion he could not find, if there had been continuous working, that the guarantee would not have been complied with. He was satisfied on the whole that the furnace was fitted for its work, but it was a long time being got into proper order, and defendants were entitled to recover as to certain expenditure for wages, electricity, &c. He gave the plaintiffs judgment on the claim for £1,139 14s. 7d. and costs, and on the counterclaim he gave the defendants judgment for £289 16s. 2d. and half the costs of the counterclaim.

Pittman *v.* May & Wallrock.

Mr. Geo. Pittman, electrician, of Shenley Road, Camberwell, sued, in the King's Bench Division, Mr. Jerome Walter May, of New Bond Street, and Mr. Samuel Wallrock, of Brook Street, Hanover Square, for £220 for an electrical installation at the Brixton Hall, and suggested that he found, after the instructions of Mr. May, that the defendants were in partnership as the Brixton Dancing Palace, Ltd., but he knew nothing of the company till he received a notification from its receiver and manager. The receiver said he had surrendered the lease as he was unable to pay the rent. Mr. May replied that he acted, and to plaintiff's knowledge, as agent for the Brixton Dancing Palace, Ltd., and Mr. Walrock said that he was never in partnership with Mr. May.

Mr. Justice Rowlatt, giving judgment, said the question was whether the electrician was employed by Mr. May personally or employed by Mr. May on behalf of the company. This sort of dispute showed what his Lordship thought was often neglected, but in the result could never be safely neglected. It showed how important it was that a contractor, when he was asked to do work, should say, "Who am I doing it for?" and if he was told it was a company he ought to find out whether it was worth the money. The electrician had done work for Mr. May's own house. In respect of the work here in question, May asserted and plaintiff denied that there was mention of the company. The documents were against plaintiff. He addressed the Brixton Dancing Palace, and received three cheques signed by the company. Plaintiff said he did not notice the company's name on a document, but persons should notice things in business, and this showed him as clearly as possible that the persons to whom he was giving a receipt were the Brixton Dancing Palace, Ltd., and that the rest of the money was to come from them. He might have said "the contract was with May; I am not going to have it altered now." He did not, and he did not sue May till the company had practically gone to pieces. His Lordship did not feel justified in giving him a judgment against May, sorry as he felt for him. Had it been that May had no money and the company had been prosperous, it would have been said for the company, had he sued it, "Oh, you sue May." The plaintiff, unhappily, must lose his case.

Postmaster-General *v.* Herbert E. Brooks.

In the Railway and Canal Commission Court, consisting of Mr. Justice Lush, Mr. Tindal Atkinson, K.C., and Sir Lewis Coward, K.C., on Monday, May 1st, a considered judgment was given in the re-heard action in which Judge Crawford, at the Romford County Court, had fixed the rent which the Postmaster-General should pay for telegraph poles on the land of Mr. Herbert E. Brooks, J.P., of Stofford Lodge, near Grays, Essex. The County Court Judge had fixed the rent of several poles at 5s. each, of some at 15s., and one at £1.

Mr. Justice Lush said the application ought to have been made in the first instance to the Railway and Canal Commission Court, and not to the County Court Judge, who had no jurisdiction when the case related to the land of a private owner. The case, he continued, raised a question of general importance as to the position and rights of the Postmaster-General with regard to the construction and maintenance of telegraph poles and wires on the land of a private owner. This was the first case which had been before that Court under the Telegraph Construction Act of 1916, which enabled the Postmaster-General to apply to the Court for a compulsory order if the owner refused his consent to having the posts on his land. His Lordship, having traced the extension of the right of the telegraph authorities to carry their wires over the land of other persons, said the Act of 1916 brought the land of private owners within the range of the limited compulsory powers previously conferred on the Postmaster-General. The application was made under the Act of 1916, Mr. Brooks having refused his unconditional consent to the posts and wires

being maintained on his land. They were first erected under an agreement between Mr. Brooks and the National Telephone Co., which had come to an end. A difference arose between Mr. Brooks and the Postmaster-General, and this difference was referred to Judge Crawford in the County Court, who made an award directing certain annual payments to be made in respect of some of the poles. The Postmaster-General was dissatisfied with the award, and applied that it should be referred to that Court. In his Lordship's opinion a mistake had been made in the procedure adopted. The difference ought to have been referred to that Court in the first instance and not to the County Court Judge, who had no jurisdiction to deal with the matter. It was never intended that a dispute as to the compulsory entry on land of a private owner should be referred to a magistrate or County Court Judge in the first instance. As this was not an appeal from the County Court Judge, the question was not of importance in that case, but similar cases in future must come first to that Court. Mr. Brooks had properly admitted that the question was only as to the terms and conditions under which his consent should be given, and this was obviously a matter of considerable public importance. The poles in question were on woodland belonging to Mr. Brooks and near a private road, which was also his property. If the convenient user or enjoyment of the land was interfered with, such interference was subject to proper consideration. The land in question had a valuable bed of chalk under it which would shortly be developed or sold in order that the chalk could be worked, and Mr. Brooks's chief complaint was that it would be a serious inconvenience to him and would certainly cause him loss as a prospective vendor of the land to have these obstructions there. His Lordship thought that the amenities of the land were substantially affected by the existence of the posts and wires, and particularly in respect of three of the posts a substantial payment ought to be made in respect of that inconvenience. He held that the sum of 5s. each ought to be paid for all the posts except those three. For two of the latter 10s. each should be paid, and for the third 20s. He did not think that these sums were excessive when the posts and wires were carried right across a wood with a right to entry on the land, and necessarily involving a substantial interference with the amenities enjoyed. Moreover, the Postmaster-General had the advantage of taking these short routes for his telegraph wires. Mr. Harold Murphy, for the Postmaster-General, had stated that in a large number of cases owners of land had been content to accept 1s. a year, and that if a larger sum than 5s. was awarded the Postmaster-General would be met with exorbitant claims. The answer to that, said his Lordship, was that each case must depend on special circumstances, and the present case, which justified those terms, must not be treated as a precedent applying to all cases. If a landowner made an unreasonable demand which was successfully resisted, the Court had power with respect to the costs, and the owner might have cause to regret making his claim. In the present case, Mr. Brooks was entitled to his costs.

Mr. Tindal Atkinson and Sir Lewis Coward concurred.

Mr. Brooks said he had not incurred any substantial costs, and he did not propose making any claim in that respect against the Postmaster-General.

Mr. Justice Lush said that in that case there would be no order as to costs.

Workmen's Compensation.

In the Mayor's and City of London Court, on Monday, a claim was made by George Scott, labourer, Bermondsey, under the Workmen's Compensation Act, against B. C. Taylor, proprietor of the B.T.T. Electric Lamp and Accessories Co., 10, Rangoon Street, Crutched Friars, for compensation for injuries that befell him on February 3rd at Black Lamb Alley, Upper Thames Street. Plaintiff's case was that on February 3rd, during the course of his employment, he was standing in the street waiting for a barrel filled with electric bulbs to be lowered three storeys on to the street. While the barrel was being lowered it slipped out of the sling and struck Scott, injuring his head, nose, right wrist, right knee and lip. His wages were £3 10s. a week. He claimed 35s. a week from the date of the accident, but defendant now agreed to pay £17 compensation and £8 costs, which plaintiff accepted. The Court approved.

Bradford Contractor Fined.

At Bradford Police Court, on April 25th, Harry Wilkinson, builder, of Baring Avenue, was charged with obtaining electricity by improper means from the Bradford Corporation, and William Threapleton, an electrical contractor, was summoned for connecting up to a Corporation line without permission. It was stated that Threapleton was engaged to install electric lighting equipment in Wilkinson's house, but he failed to send in the "test notice" required by the Corporation before the cable was connected with the main, and electricity was used which had not passed through the meter. Wilkinson's defence was that he knew nothing about the regulations and trusted to the contractor he employed to see to such matters. The defence of Threapleton was that he had been ill and the connection was made without his realising the breach of rules.—The Bench dismissed the case against Wilkinson, believing that, like any ordinary householder, he had engaged someone to do the work, who, he supposed, was qualified to take the responsibility, though appearances pointed to his having known something of the matter. Threapleton was fined £5, the Stipendiary Magistrate pointing out how important the test was in avoiding risk of damage, or even fire, quite apart from the matter of meter charges. Even if defendant were ill it was his duty to see that the work was done properly.

Charge of Fraudulently Extracting Electricity.

At the Larne (Co. Antrim) Magistrates' Court, Hugh J. McKerrell, motor garage proprietor, was charged by the Larne Electric Light Co. with fraudulently abstracting electricity from the company's main.

John Williamson, an electrician in the company's employment, stated that he found two wires connected to the main and leading into the garage, being there connected to a 100-watt lamp, a portable lamp of 40 or 60 watts, and a board for the charging of accumulators erected on the wall. The current for these lamps did not pass through the meter. For the quarter ended December 31st last defendant's meter only registered six units, but collectively the lamps on his premises would consume one unit in 2¼ hours. When spoken to, defendant said he had only just connected the wire in order to get a light into the oil store.

The Court committed McKerrell for trial at Quarter Sessions, but allowed bail.

The Testing of Small Electrical Plant.—At a meeting of the Society of Engineers, on May 1st, Dr. C. V. Drysdale, O.B.E., continued his discourse on the above subject. He first dealt with the testing of d.c. generators and motors by the use of a regenerative brake, giving details and curves of actual tests. The speed was best measured by a roller stroboscope, although a vibrating reed or other good tachometer would serve. The direct method of testing the ratio of input to output was detailed, and then the indirect method was reviewed, the way in which fixed and variable losses were measured being explained. Dr. Drysdale showed that the agreement between the direct test and the indirect estimate was remarkably close, and ascribed the higher effective armature resistance obtained by the indirect method, to losses due to short-circuit currents in the armature coils at commutation. Curves were shown illustrating the performance of an induction motor running both as a motor and as an asynchronous generator, and the methods of ascertaining phase displacement were described. In making indirect tests of induction motors, the author said that it should be remembered that as they were rotating field-machines, the true no-load condition of the machine should be considered as that when the rotor was running at the synchronous speed. In this condition with a polyphase machine, the rotor bars were cutting no flux, and there was no torque on the rotor, so that if the electrical input was measured when the rotor was rotated at the synchronous speed, by means of a small regenerative brake, the wattmeter showed the stator core loss, plus the stator C^2R loss for the no-load current, while the brake gave the bearing friction and windage torque at the synchronous speed and under running conditions. In the case of single-phase induction motors, where the rotating field was produced by the reaction of the rotor on the stator current, the wattmeter reading at synchronous speed gave the sum of the stator core loss and the stator and rotor losses at no-load. Direct testing of synchronous alternators and motors was then touched upon, and results of indirect tests were illustrated by curves. In conclusion, the author mentioned methods of testing large alternators and transformers.

Wireless and Kinematography.—In a Chicago film studio (says the *Evening News*) the combined use of the wireless telephone and the kinematograph has been successfully tested. An actor talked under wireless telephone broadcasting conditions, while watching his movements in a film on the screen. The film was a "master reel" controlling the projection of copies in various other places. As the various test audiences viewed the several identical reels, running simultaneously under a method of electrical synchronisation, they heard the actor's voice.

Electric Vehicles at Birmingham.—In a report of the Birmingham Corporation Salvage Department, just issued, the Committee states that the Department has at present a fleet of 34 electric vehicles, and that it is intended to buy seven more. The vehicles are used in the collection of refuse on the continuous system in those districts which are at considerable distances from depôts, and which could only be worked on the continuous system by horse haulage at greatly increased cost. The city is divided into small areas, to each of which a collection vehicle is allocated. The object of the system is to ensure that every house on a particular round shall be visited weekly, so that all receive equal treatment. Nearly half the city is now provided with a continuous system of collecting refuse by means of electric vehicles. It is considerably superior to the old system of collecting by means of horse-drawn wagons. The two new 100-kW generating sets at the Montague Street destructor works are giving satisfaction. A quarter of a million tons of refuse are collected in Birmingham annually and dealt with at the destructor works.

BUSINESS NOTES.

Bankruptcy Proceedings.—William John Dicken, trading as W. Dicken & Sons, electrical engineers, 2, Upper High Street, Bargoed.—The examination in bankruptcy took place at Merthyr, on April 27th. The deficiency was returned as £130 on liabilities of £595. Debtor stated that for nine years prior to January, 1920, he was employed as an electrical engineer by a company at Rhymney, latterly at a salary of £600 per annum. The business was then acquired by another company and his services were dispensed with. In October, 1920, he commenced in business with £550 capital, money that he had saved, taking his premises on a seven years' lease, at an annual rent of £200, and rates. The business, however, did not pay from the beginning. Trade depression and the slump in prices combined to make matters impossible for him, and in January last he found himself insolvent. The examination was closed.

Samuel Holmes, 20, Gladstone Road, Halifax, trading at Palatine Chambers, Halifax, as Holmes & Co., electrical engineers.—A meeting of creditors was held on April 28th, at Halifax. The debtor's statement of affairs showed gross liabilities of £629, and the deficiency £623. It was stated there were seventeen unsecured creditors. Inexperience, heavy working expenses, and illness were given as reasons for failure. The matter was left in the hands of the Official Receiver.

W. W. Threapleton, electrical and mechanical engineer Thornbury Road, Bradford.—Receiving order made April 26th, on debtor's own petition. First meeting: May 10th. Public examination, May 24th.

J. B. Robertson, electrical engineer's manager, Whitbarrow Lane, Lymm.—Receiving order made April 24th, on debtor's own petition. First meeting, May 10th, at Liverpool; public examination, June 2nd, at Warrington.

R. T. Morrison, electrical engineering contractor, 82, Lumb Lane, Bradford.—First meeting May 6th, at the Official Receiver's Offices, Bradford; public examination May 24th, at the County Court, Bradford.

P. Rothwell (trading in partnership with P. A. Rothwell, a minor, as P. A. Rothwell & Co.), electrical engineer, 64, Higher Bridge Street, Bolton.—Last day for proofs for dividend May 13th. Trustee: Mr. J. G. Gibson, Official Receiver, Byrom Street, Manchester.

W. Bennett, electrical contractor, Back Sitwell Street, Derby.—First and final dividend of 1s. 1¾d. in the £, payable May 10th, at the Official Receiver's Offices, 4, Castle Place, Nottingham.

Charles Archibald Henderson, 63, Queen Victoria Street, E.C.—Under a receiving order made on April 12th against this debtor, who had carried on business as an insulating materials merchant, the creditors met at the London Bankruptcy Court on Monday before Mr. F. T. Garton, Official Receiver. The petitioning creditor, so it appeared, was a moneylender. The Official Receiver reported that, according to statements that the debtor had made, he joined the Army in 1917 [illegible] was demobilised in October, 1919, with the rank of Lieutenant. Shortly afterwards he bought for £450, which he borrowed, the business of Allen & McMaster, insulating materials merchants. The trading was a success until some nine months ago, when he found himself short of capital in consequence of guarantees, some of which he had to pay, in respect of loans to friends. He also stated that certain of his customers curtailed their credit when they heard that it was his intention to manufacture on his own account. He had been hoping from day to day that friends would provide the money necessary to equip a factory, but he had done practically no business for some months past. He roughly estimated his liabilities at £2,000, of which he said £500 was due to moneylenders and the balance in respect of trade accounts. He attributed his present position to the failure to equip a factory to manufacture the goods in which he had dealt and to heavy interest and loans and guarantees for friends. On the debtor's behalf it was stated that he was prepared to make an offer for the payment of 7s. 6d. in the £ to trade creditors. It was understood that for the purposes of such a proposal the family creditors would withdraw their claims. On behalf of the creditors, Mr. Webb pointed out that the bankruptcy petition was adjourned for months to enable the debtor to make a proposal. He was not very hopeful. The chief creditor, however, remarked that he was in favour of an adjournment, and the Official Receiver thereupon adjourned the meeting until May 22nd.

Charles Frederick Nason, 93, Butt Road, Colchester, electrician.—The public examination of this debtor was held recently at the Law Courts, Town Hall, Colchester. The statement of affairs showed liabilities of £103, and there was a deficiency of £72. Debtor stated that he had been an electrician for 30 years, and had saved about £20 when he started in business. He attributed his failure to the expenses entailed consequent on the illness and death of his wife, to the illness of his children, and lack of sufficient trade. After further questions the examination was adjourned.

Percy Chas. Maidment, electrical engineer, &c., 13, Beauchamp Place, South Kensington, S.W.—This debtor attended before Mr. Registrar Francke on April 28th at the London Bankruptcy Court for public examination upon accounts showing liabilities £1,688, against assets valued at £92. Replying to Mr. Vyvyan, Official Receiver, the debtor stated that he served in the Army from February, 1916, to February, 1919, when he was demobilised. He then entered into partnership with two other persons, and commenced business as electrical engineers under the style of "Wright Bros. and Maidment," at 164, Sloane Street, S.W. In August, 1919, the partnership was dissolved, witness agreeing to pay his late partners £4,250 for their interest in the business, stock, lease, and fixtures. He continued the business under the style of "P. C. Maidment" until March, 1921, when he sold it for £4,500. He then commenced as an electrical engineer, builder, &c., at 13, Beauchamp Place, and traded until the stock was sold under an execution in January last, since when he had been without regular occupation. Witness attributed his insolvency to lack of capital and bad trade. The examination was concluded.

Aneurin Tudor Williams and William John Bevan, trading as the Electrical and General Engineering Co., 49, Commercial Street, Aberdare, electrical engineers.—The public examination of these debtors was held recently at the Temperance Hall, Aberdare. The liabilities were returned at £1,709, against assets of £437, or a deficiency of £1,272. It appeared that debtors started business in partnership with £100 capital, contributed in equal shares, in December, 1919. For the first few months they were successful, but in consequence of the moulders' strike in 1920 much difficulty was experienced in obtaining materials, and this resulted in the loss of work. They were also affected by the coal stoppages of October, 1920, and April, 1921, and subsequently, through keen competition, prices had to be cut considerably. They became aware of their position in August, 1921, but continued trading in the hope that matters would improve. After further questions, the case was adjourned to enable debtors to amend their deficiency account.

William Camp, trading as William Camp & Co., Carr Lane, Slaithwaite, near Huddersfield, electrical engineer.—The first meeting of creditors was held recently at Huddersfield. The statement of affairs showed gross liabilities of £593, all of which was expected to rank against assets of £100, or a deficiency of £493. Debtor attributed his failure to shortness of capital, bad trade, and ill-health. The case being a summary one, was left with the Official Receiver.

W. F. Rimmer, electrical engineer, 21, Ellesmere Street, Patricroft, Lancs.—Receiving order made April 28th on creditor's petition.

Company Liquidations.—Hubert D. Carter (Bangor), Ltd., electrical merchants, &c., Bangor.—In pursuance of the provisions of the Companies (Consolidation) Act, a meeting of creditors was held recently at the offices of Messrs. A. McIntyre & Co., accountants, Strand Buildings, Colwyn Bay. The statement of affairs presented showed ranking liabilities of £2,073. The indebtedness to the trade was £1,035, while Mr. H. D. Carter was a cash creditor for £155, and there were arrears of salary due to him of £794. The assets were estimated to realise £617, or a deficiency as regarded the creditors of £1,456. The assets consisted of book debts £357, expected to produce £300; stock at cost £223, valued at £200; fixtures and fittings, &c., £39; materials on jobs, £5; and cash in hand, £73. The nominal capital of the company was £5,000 divided into 2,000 preference shares and 3,000 ordinary shares, all of the face value of £1 each. The issued capital was £2,502, consisting of 1,000 preference shares and 1,502 ordinary shares. The company was registered in February, 1920, when it took over an existing business as a going concern. The company was to act as a distributing agency for another concern on a 10 per cent. basis. The purchase price paid by the company was £2,500, practically all of which was satisfied by the allotment of fully-paid shares. Only two shares were issued for cash. Mr. Carter was entitled to a salary of about £400 per annum, but he had never received anything, and was now a creditor for a substantial amount. A petition had been presented for the compulsory winding-up of the company, but it was stated that if the voluntary liquidation was continued Mr. Carter would withdraw his claim for £794. Several creditors expressed the opinion that it would not be advantageous for compulsory liquidation to take place, and a resolution was passed confirming the voluntary liquidation with Mr. G. G. Poppleton, of Messrs. Poppleton & Appleby, C.A., Corporation Street, Birmingham, as joint liquidator.

United Engineering Co., Ltd.—Last day for proofs for dividend, May 15th. Liquidator: Mr. H. E. Burgess, Senior Official Receiver and Liquidator, Carey Street, W.C.

Watts, Williams & Co., Ltd., electrical engineers, Leysfield Road Works, Goldhawk Road, Shepherd's Bush, London, W.—A meeting of creditors was held recently, when a statement of affairs was submitted which showed ranking liabilities of £25,607, against assets estimated to realise £11,027. After allowing £198 for preferential claims, the assets were estimated to realise £10,829, or a deficiency of £14,778. The principal assets were freehold land and buildings, £9,156, expected to produce £4,500; plant, &c., £5,474, estimated to

realise £2,000; stock and tools, £7,902, valued at £2,500; and doubtful and bad debts, £9,740, estimated to realise £1,350. The goodwill, patents, &c., appeared in the books at £5,466, but no value was placed upon them in the statement of affairs. The company also held shares of the face value of £4,950 in the British Generator Co., Ltd., on which no value was at present placed. It was reported that the company was registered in April, 1920, with a nominal capital of £60,000, and shares to the value of £35,700 were issued for cash. A further 5,000 shares of £1 each were issued as fully paid to the British Generator Co., Ltd., as consideration for assets transferred. The company had manufactured lighting sets, but had experienced great difficulty in perfecting them while the sole selling agents recently went into voluntary liquidation owing Watts, Williams & Co., Ltd., £2,200, of which nothing had yet been paid. The company had also carried on a welding business and repair shops. During the year ended March 31st, 1921, there was a loss on the trading of £8,350, while since that date there had been further losses aggregating £16,000. Owing to the heavy losses the directors and their friends had advanced substantial sums to enable the company to continue, and they were now cash creditors for rather more than £18,000. After a short discussion the creditors decided to confirm the voluntary liquidation of the company with Mr. F. J. Carpenter, of Messrs. W. B. Keen & Co., C.A., 23, Queen Victoria Street, E.C., as liquidator.

British Generator Co., Ltd.—Winding up voluntarily. Liquidator: Mr. F. J. Carpenter, 23, Queen Victoria Street, E.C. Meeting of creditors, May 8th, at Queen Victoria Street, E.C. Particulars of claims by May 27th.

Imperia Co., Ltd.—Winding up voluntarily. Liquidator: Mr. J. N. Calvert, 25, Water Street, Liverpool.

Stanton & Co., Ltd.—Meeting of creditors at the offices of the liquidator, Mr. H. V. Watson, 29, Friar Street, Leicester, May 8th. Particulars of claims by May 24th.

Sequestration.—The estates of Livingstone & Malcolm, electricians, 7, Canal Street, Coatbridge, and of J. Livingstone and F. Malcolm, the individual partners of the said firm as partners, and as individuals, were sequestrated by the Sheriff of Lanark on April 26th. Meeting to elect Trustee and Commissioners, May 8th, at the County Buildings, Airdrie.

Dissolutions of Partnership.—Heath Electrical and Mechanical Engineering Co., electrical and mechanical engineers, 1, Pembroke Terrace, Cardiff.—Mr. E. W. Bartlett and Mr. S. C. Crocker have dissolved partnership. Mr. Crocker will attend to debts and continue the business under the same style.

Bill & Berry, electrical engineers and manufacturers' agents, 18 to 26, Constitution Hill, Birmingham.—Messrs. W. H. Bill & J. H. Berry have dissolved partnership.

Denyer & Hayler, electricians, 89, Sackville Road, Hove.—Mr. F. Denyer and Mr. A. W. Hayler have dissolved partnership. Debts will be attended to by Mr. Hayler.

Trade Announcements.—Messrs. W. E. Beardsall & Co., Ltd., of Mynshull's House, Cateaton Street, Manchester, notify us that their telephone number has been altered to "City 906-7."

Messrs. Arthur Jones & Co., of 15, Dock Street, Middlesbrough, have been appointed sub-agents for Middlesbrough and Teeside under the Simplex and Credenda Joint Sales Service, and they hold stocks of the manufactures of both Simplex Conduits, Ltd., and Credenda Conduits Co., Ltd.

Mr. G. Lock, lately with the Surbiton Electric Co., Ltd., has commenced business as an electrical engineer, at 164, Thornhill Road, Tolworth, Surbiton.

Messrs. John M. Henderson & Co., of Aberdeen, have made arrangements with Mr. F. G. Mitchell, of The Mitchell Conveyor & Transporter Co., Ltd., contracting engineers, 45-50, Holborn Viaduct, London, E.C.1, to undertake the manufacture of Krom crushers, Maxecon Mills, and new-type Kent mills for that company. They have also acquired joint selling rights of these machines.

Messrs. Shenton & Co., Ltd., have opened a new branch at 3, Park Lane, Queen Street, Cardiff, where Mr. G. W. Richards (formerly with Messrs. Drake & Gorham (Wholesale), Ltd., at Liverpool) is manager.

Mr. Horace Hind has commenced business on his own account at Exchange Buildings, Stockton-on-Tees, as a consulting, electrical, and mechanical engineer—re-establishing the firm of Hind & Son carried on in Stockton since 1837 by his late father. The firm wishes to receive copies of catalogues, &c.

Messrs. Green & Smith, Ltd., of Albert Works, Meadow Lane, Leeds, have been appointed sole agents in the West Riding of Yorkshire for Messrs. Greenwood & Batley, Ltd., of Leeds, makers of dynamos, alternators, motors, &c.

Messrs. Drake & Gorham Wholesale, Ltd., announce that Messrs. H. R. Cleave & Co., at 6, Bristol Bridge, Bristol, having resigned their agency by mutual consent, they have opened a depôt at 35, Broad Street, Bristol, under the management of Mr. A. J. Nicoll, who has been with the company for the past sixteen years. Telegraphic address: Dragorlite Bristol.

Messrs. H. R. Cleave & Co. are now trading as factors in their own name, and will continue to carry large stocks of lamps.

Messrs. Connolly's (Blackley), Ltd., electrical cable manufacturers and sole makers of Connolly's Blackley tape and enamelled wire, are moving their London office from Finsbury Square, City, back to Westminster, their original address (given up at Government demand). As from May 8th their address will be 16, Victoria Street, Westminster, S.W.1. Telephone: Victoria 636°. Telegrams: "Lifehold Vic London."

Catalogues and Lists.—Callender's Cable & Construction Co., Ltd., Hamilton House, Victoria Embankment, E.C.4.—Two illustrated and priced pamphlets, one dealing with "Callender" cut-outs of various types, and the other with unit type cable racks. Also an illustrated booklet describing an improved design of network joint or disconnecting boxes.

Messrs. J. H. Holmes & Co., Portland Road, Newcastle-on-Tyne.—A well-illustrated and priced catalogue of a.c. induction motors for pressures up to 650 V, at various frequencies. Full specifications are given and a great amount of technical information also appears.

Sterling Telephone & Electric Co., Ltd., 210-212, Tottenham Court Road, W.1.—Publication No. 319, giving reduced prices for articles contained in the 11th edition catalogue.

Messrs. Higgs Bros., Sand Pits, Birmingham.—Monthly Magazine for May, giving details and prices of two- and three-phase induction motors, and d.c. motors and dynamos; also notes on manufacture, &c.

Messrs. Gent & Co., Ltd., Faraday Works, Leicester.—Publication 388, giving revised and reduced prices of telephone apparatus, &c.

Credenda Conduits Co., Ltd., Whitehouse Street, Aston, Birmingham.—List No. CL 123, giving prices and illustrations of toasters, kettles, hot-plates, fires, and other electrical appliances.

For Sale.—By direction of the Disposal Board, Messrs. T. Whitfield & Son are selling by auction on May 18th and 19th, at Shawbury Aerodrome, Shrewsbury, machinery, electric light and power plant, cable, &c.

Carlisle Corporation Electricity Department invites offers for one d.c. turbo-generator set, surface condenser, air pump and circulating pump.

Oldham Corporation Electricity Department has for disposal one Babcock & Wilcox land-type water-tube boiler (25,000 lb. per hour), complete with chain-grate stoker, Green's economiser, and induced draught plant, and one 1,200-kW Brush d.c. turbo-tandem generator with condensing plant. (See our advertisement columns to-day.)

Swedish Engineering Industry.—In the March *Swedish Economic Review* it is stated that in spite of the fact that some works have increased production, the number of persons employed in the engineering trades is still declining:—

Number of employés	Wharfs	Electrical industry	Other mech. industries
Sept. 1st, 1920	10,000	7,500	41,600
June 30th, 1921... ...	5,900	5,000	21,500
January 1st, 1922 ...	4,100	4,000	18,900

"German competition is to a great extent the crux of the situation, and will remain so, as long as the declining mark exchange counterbalances the decrease in the cost of production. Lately several foreign orders have, however, been placed in Sweden on account of the tardy delivery of the German works. The Russian orders placed in Sweden, which mainly concern locomotive engines, keep about 4,000 workers engaged."

Armstrong-Whitworth's Hydro-Electric Enterprise.—In May, 1920, Sir W. G. Armstrong, Whitworth & Co., Ltd., initiated a hydro-electric section as a part of their civil engineering department, to secure orders for water turbines to be manufactured at their Elswick Works to the designs of a well-known Norwegian firm. The volume of business laid before the hydro-electric section since it was first established was such as to cause the board to decide to form a separate hydro-electric department, as a unit apart from the civil engineering department, as from January 1st, 1922. The new department, like the old hydro-electric section, is dealing with complete water power development schemes throughout all the various stages, no less than with the various component parts of such schemes, civil engineering, mechanical and electrical. Messrs. Armstrong now have survey parties out in many parts of the world looking into projects which have been brought before them for submission to the powerful financial group with whom they are working in the city of London, and it can only be anticipated that the part they will play in the coming era of intensive hydro-electric development in the Empire will be a very important one, not only in the Empire, but in all parts of the world. The offices of the hydro-electric department are at 8, Great George Street, Westminster, S.W.1, and the department is under the management of Mr. Douglas Spencer, who is assisted by well-known hydro-electric engineers—Mr. Robert P. Tod, Mr. V. Bataillard, and a large staff of British engineers.

A Silvertown Award.—A financial daily paper states that the India-Rubber, Gutta-Percha and Telegraph Works Co., Silvertown, E., has been awarded the first prize, £1,400, in the Air Ministry competition for safety fuel tanks for aircraft.

New Argentine Company.—There has been formed at Rio de Janeiro (146, Rua Evaristo da Veiga) a company with the style of Amadeo Disante e Ca, for trade in electric accumulators. Capital 100,000 milreis.

Crompton's Athletic Club.—The annual general meeting of Crompton's Athletic Club was held in the Club House, on Saturday, April 22nd, Mr. J. Ankers presiding over an enthusiastic meeting. The secretary, Mr. P. G. Cheverton, in presenting the report and accounts, referred to the kindness of the directors in bearing the full cost of the Christmas tea and entertainment to the wives and children. Mr. T. Britton, manager and director, was re-elected president, and the following were re-elected vice-presidents, with the addition of Mr. W. J. Freeland and Mr. H. Church :—Lieut.-Col. J. Clibborn, C.I.E., H. Burge, T. E. Dann, T. Gray, Major W. C. Hale, M.C., J. H. Johnson, A E. Hohring, P. Morgan, Saxton, W. A. Noble, C. Peel, J. A. R. Pitts, E. Reeves, J. A. Rennie, A. A. Campbell Swinton, F.R.S., C. F. Turnell, T. Taylor, J. Houblon, J. N. Watson, and Sir Glyn West. Mr. P. G. Cheverton was re-elected Hon. Sec., Mr. J. C. Cubitt was confirmed by the meeting as his assistant, while Mr. J. Barker was re-elected Hon. Treasurer, and Messrs. W. Crabb and F. Thompson Hon. Audtiors. The committee for the ensuing year was elected.

Electricians' Wages in Cape Town.—A new rate of pay for electricians came into operation upon April 1st as follows: skilled men, 2s. 8d. per hour; men with over five years' experience, minimum 2s. 2d. per hour.

Transformers for Canada.—H.M. Trade Commissioner at Winnipeg reports that a Western Canadian firm has recently consulted him regarding the supply of electric transformers. General particulars of the type used in Canada have been forwarded to the Department of Overseas Trade, together with a rough sketch and particulars of tendering conditions. United Kingdom manufacturers may examine these, and the name and address of the company referred to may also be obtained upon application to the Department at 35, Old Queen Street, S.W.1.

"Pulsynetic" Electric Clocks.—The Liverpool Overhead Railway has placed an order with Messrs. Gent and Co., Ltd., for an installation of "Pulsynetic" electric clocks. Waterproof impulse clocks in cast-iron cases are being fitted at every station on the system, as well as in signal cabins, the power station, and administrative departments, and all are controlled by a master clock or "transmitter" fixed at Dingle Station. The installation proves to be one of more than ordinary interest, because the connecting wires which loop up the clocks are "broken" when the draw-bridge at Clarence Dock swings, and the time-keeping of the whole system is not affected by this temporary disconnection. Further, the vibration of the steel structure, caused by passing trains, does not affect the time-keeping of the impulse clocks. Uniform time over the whole railway is thus ensured.

The Tenders for Brazilian Railway Electrification.—The Rio de Janeiro correspondent of *The Times* reports that tenders for the electrification of the Central of Brazil State Railway were opened last week in the presence of the interested parties. Offers were received from the General Electric Co. (American), the Metropolitan-Vickers Electrical Co., Ltd. (British), and the Westinghouse Co. (American).

"The proposals all contain so many alternative specifications that as yet it is impossible to state which is lowest, but cursory examination induces the belief that the lowest tenders are in the order mentioned, with little difference between the Vickers and the General Electric. Government experts will have some time for the study of the proposals before the award is made. The total value of the contract is about £2,000,000. It is interesting to note that representatives of several important American banking houses are taking part in the negotiations with the Government for financing this work."

Book Notices.—"Practical Engraving on Metal," pp. viii+141, figs. 100. Price 1s. 6d. net. "Maintenance and Repair of Electrical Measuring Instruments," by H. G. Yarrill. Pp. vii+78, figs. 21. Price 2s. 6d. net. "Beginner's Guide to the Microscope," by C. E. Heath. Pp. 120, figs. 46. Price 1s. 6d. net. London: Percival Marshall & Co.

The *Journal* of the South African Institution of Engineers. Vol. XX, No. 8, March, 1922. Johannesburg: The Institution. Price 2s. net.—This issue contains a paper and discussion on "The Preservative Treatment of Mine Timber," and a discussion on "Oil for Power Production."

Bulletin No. 6, "On the Electro-Deposition of Iron," by W. E. Hughes, B.A. (Cantab.). London: H.M. Stationery Office. Price 6s. 6d. net.—This publication contains the results of researches made by Mr. Hughes, with the assistance of grants made by the Department of Scientific and Industrial Research. The first part is descriptive, and deals with the effects of temperature, current density, and mechanical movement. The second part is devoted to theoretical considerations, &c., including the crystallisation of substances in general; application to electro-deposited metal; and workshop application. An appendix contains a bibliography relating to the electro-deposition of iron, and the properties of electrolytic iron. The report is copiously illustrated by photomicrographs.

"Dynamo Design and Construction," by A. H. Avery. Pp. viii+264, 254 figs. London: Cassell & Co., Ltd. Price 6s. net.

Transactions of the South African Institute of Electrical Engineers. Vol. XIII., Part I, Jan.-Feb., 1922. Johannesburg: The Institute. Price 2s. net.—This contains a report of the annual general meeting on February 16th, and the inaugural address of the new President, Mr. E. V. Perrow. The accounts presented showed the financial position to be very sound. This issue also contains a discussion on a paper by Mr. B. Sankey, entitled "Reinforced Concrete Poles for Overhead Line and Traction Work"; and a memorandum addressed to the Minister of Railways, jointly by the South African Institution of Engineers and the Institute, urging a speedy decision regarding the electrification of the South African railways, and the provision of an abundant supply of electricity for industrial purposes.

"Coal Saving by Modern Methods of Steam Generation," by David Brownlie, B.Sc. (Hons.), &c. (15 pp.).—This is a series of reprints from the *Textile Manufacturer*, giving the results of working of 65 boiler plants in the dyeing, bleaching, calico-printing, and finishing industries, consuming 275,637 tons of coal annually. It is shown that the average net working efficiency is only 61.41 per cent., while individual plants vary from 80.09 per cent. to 40.06 per cent. The publication may be obtained from the author at 4, Grangethorpe Drive, Burnage, Manchester. Price 2s. 6d. net.

Local Exhibitions.—Referring to the note on p. 593 of our issue of April 28th, regarding the electrical exhibition held by the St. Annes Urban District Council, Messrs. Baxendale and Co., Ltd., inform us that they exhibited, amongst other well-known "Universal" domestic appliances, not the "Laundry Queen" but the "Universal" clothes washer.

Water-tube Boiler Manufacture.—In the course of his speech at the meeting of Clayton & Shuttleworth, Ltd., at Lincoln, Mr. P. W. Robson, the chairman, said, with regard to the engineering dispute, that there could be no stable peace in the industry until the present issues had been settled in accordance with the employers' demand for the simple right to the unquestioned exercise of proper managerial functions in their respective works, coupled with ample safeguards to protect and preserve the proper functions of trade unionism. He was strongly of opinion that when the dispute was terminated on the employers' terms both sides would come to a closer and better understanding than had been possible for some years past, and that therefore the issues would not have been fought in vain. The company had developed a large new boiler works within the last few years, and received substantial orders from railway companies for locomotive boilers. The most important development in this department, however, was the introduction of water-tube boiler manufacture, and in this connection a very important order had been placed with the company by the London County Council for three very large units and their accessories, to be installed at Greenwich power station. Another London municipality had also within the last few days decided to adopt the company's patented boiler, and it was confidently anticipated that these preliminary contracts would be the forerunners of many others.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trade and industries. Any firm desiring to enter an opposition to any of the applications have one month in which to do so from the dates mentioned below :—

Van Dorn (lettering and design). No. 410,424. Class 6. Electrically-operated tools. The Van Dorn Electric Tool Co., 2,978, Woodmill Road, Cleveland, O., U.S.A. (F. Heron Rogers, Bridge House, 181, Queen Victoria Street, London, E.C.). April 26th, 1922.

Little Giant. No. 414,515. Class 6. Electric tools, &c. The Consolidated Pneumatic Tool Co., Ltd., 170-3, Piccadilly, London, W. April 26th, 1922.

Embassy. No. 423,157. Class 6. Electrical vacuum cleaning machines. Myer Gilston, 21a, Upperhead Road, Leeds. April 26th, 1922.

Eunex (lettering and design). No. 422,861. Class 8. Electrical accumulators (not for medical use). The Chloride Electric Storage Co., Ltd., Clifton Junction, Manchester. April 26th, 1922.

Portex. No. 422,862. Class 8. Electric accumulators (not for medical use). The Chloride Electric Storage Co., Ltd., Clifton Junction, Manchester. April 26th, 1922.

Wheel and Wing Design. No. 421,619. Class 13. Metal goods for use as parts of electric lighting and power sets, &c. The Austin Motor Co., Ltd., Northfield, Birmingham. April 26th, 1922.

Bogey. No. 422,720. Class 13. Electric hand lamps. British & Allied Electrical Agency, Ltd., 13, Charterhouse Street, Holborn Circus, London, E.C. April 19th, 1922.

Correction.—We are indebted to the Simplex Conduits Ltd., Garrison Lane, Birmingham, for pointing out a misprint in our issue of April 21st last in connection with the list of trade mark applications. The term applied for by Laurence Maxwell Waterhouse, trading as the L. M. Waterhouse Electric Co., 19, Rathbone Place, London, W.C., under No. 422,898, Class 13, in respect of electrical apparatus and fittings is "Surflex" and not "Simplex" as printed.

New Indian Companies.—Among the new concerns recently formed in India in connection with the supply of electricity for lighting and power purposes, are the following: The Multar Electric Supply Co., Multar, Punjab, capital 1,000,000 rupees; and the Punjab Hydro-Electric Power Supply Co., Delhi, capital 6,000,000 rupees.

Electrical Trade Prospects in South Africa.—*The Times* Trade Supplement (April 28th) published the following notes on the electrical outlook in South Africa, from "A Correspondent":—

"British exporters of electric plant should be on the look out for an immediate increase of orders from private and municipal sources in South Africa. Every recent month has witnessed the installation of lighting schemes in towns and villages, and the increased demand for power has forced the civic authorities at Cape Town, Durban, Johannesburg, and Pretoria to extend existing generating stations and lay down additional plant. The market for electrical machinery and material indeed, is about the only one which was not affected by the universal trade slump last year, and it is a matter for attention that oversea purchases in 1921 were valued at approximately £2,000,000 compared with £1,680,000 in 1920 and £1,040,000 in 1913. For the current year the prospects are excellent. Reports from Johannesburg and other business centres indicate that stocks of fittings, &c., are sufficient for the moment, but no secret is made of the fact that indenting on a large scale will have to be resumed as soon as the power plants now on order, have been installed. The opportunities presenting themselves are attracting the attention of American and German competitors, and although Great Britain is looked to by South Africa for the bulk of its electrical plant at the moment, manufacturers should lose no opportunity for strengthening their relations with the market. Writing with numerous recent conversations with municipal engineers in mind, it does not seem likely that many of the contracts for generating plant will be placed outside the Empire, but note should be taken of the pronounced tendency on the part of the valuable business in fittings, lamps, cooking and heating apparatus, and general accessories to pass into the hands of competitors. This, it seems, is very largely owing to want of scientific propaganda work on the part of British manufacturers. Tenders are called for publicly for generating plant, but local merchants supply fittings and accessories, and it is they who should be canvassed by representatives, catalogues, and notices of new lines and patterns. The latter point, indeed, is one to which much more attention might usefully be directed. South Africa is keen on new electrical devices of all kinds, and American manufacturers are taking pains to cultivate this ground. British exporters who want the business must follow suit or be badly left behind."

The South African Mining and Engineering Journal for April 8th, just to hand, reports on the situation as follows:—"An important dealer in electrical wares says that things are undoubtedly getting better and business is improving by degrees. Orders from outside Johannesburg are now much more numerous and for bigger quantities than has been the case for months past; in town also trade is improving. Prices show as yet no change, but the indications are that they will increase rather than decline. In wiring especially, which has recently declined considerably, the tendency will be upwards, as the cost of replacement far exceeds the price at which it has recently been sold. Porcelain is much about the same, but up to now prices locally have undergone no great change. This dealer said inquiries from the country districts and even from far afield are now of a very encouraging nature. Electrical goods are coming in freely, and there are now no shortages in any lines. The recent strike in Germany has affected deliveries from there very materially, but consignments are expected shortly."

Calendars.—Messrs. C. A. Parsons & Co., Ltd., of Heaton Works, Newcastle-on-Tyne, have issued a calendar with monthly date cards from April to December, 1922. A novel feature is a model representing a sectional view of a group of Parsons end-tightened reaction blading, showing that the radial clearance is never less than 3/16 inch, whilst the axial clearance, as demonstrated by the working of the model, is controllable by the thrust block, being enlarged when warming-up and starting, and reduced when running to a very small clearance.

The Enfield Ediswan Cable Works, Ltd., Central House, Finsbury Square, London, E.C.2, has issued a calendar with monthly sheets for the period from April, 1922, to March, 1923. Each monthly sheet also contains calendars for the preceding and the following months.

New French Company.—La Société des Usines Hydro-Electrique du Samson is the name of a new company which has lately been formed at Samson (Commune de Maizeret), with a capital of 1,000,000 francs.

Lead.—Messrs. James Forster & Co. report under date April 29th:—

"The position, having regard to the cessation of shipments from Australia, is not without anxiety. Consumption remains very poor. The electrical trades are working at under 50 per cent. of the normal, and the domestic trades continue to consume only about 5,000 tons per month. Export business is also very quiet.

Kitchen Reform.—The kitchen of the Reform Club, Pall Mall, is to be modernised and re-equipped this summer, and the contract for this work has been placed with Messrs. Benham & Sons, Ltd., of Wigmore Street, W., who originally fitted up this kitchen in 1842.

Social Events.—On April 26th the Simplex Social and Welfare Club held the last of a successful series of concerts, for the year 1921-1922, in the new canteen of the works, at Birmingham. This was carried out under the direction of Mr. Frank Trotman, the well-known Birmingham comedian, who is also a member of the Simplex staff. Mr. E. P. Bennett, the president of the club, took the chair, and he was supported by Messrs. A. J. Spiller and W. B. Randall (vice-presidents), Mr. H. F. McLoughlin, and members of the Social Welfare Committee. Mr. Ralph Seaton acted as secretary.

Unemployment.—In future unemployment returns issued by the Ministry of Labour will apply to Great Britain only. The total number of registered unemployed on April 24th was 1,640,100 as compared with 1,633,926 a week earlier. There was a decrease of over 12,000 in workers on "short time." Relief schemes had absorbed, up to April 22nd, 134,059 persons.

West Midlands D.I.C.—The second annual meeting of the No. 5 (West Midlands Area) District Industrial Council for the Electricity Supply Industry was held on April 28th. A very satisfactory report was submitted and approved. Among the subjects mentioned in the report was that of the variation of standard working conditions for small undertakings; both sides of the Council were agreed that this was necessary, and steps were taken in this direction. Other points reviewed were wage adjustments; short-time working; works committees; and apprentices' wages. The accounts showed a credit balance of over £11.

Russia's Electrification.—According to the Russian official economic journal, a great step forward has been made in the general scheme of electrification by the establishment of a connection between the different power stations and works in the different provinces, a system which is said to be almost completed in the South Russian provinces and the district of the Urals. The journal suggests that a beginning should now be made with the conversion of the railways, taking first the lines which traverse the Donetz coal basin, and then gradually making extensions to the other railways.

The Russian Trade Delegation learns from Moscow that a large electrification bank is being organised with the participation of foreign banks, notably the Credito Italiano, to promote electrification works in Russia.—*Reuter's Trade Service.*

Trade Boom in Saxony.—Addressing the shareholders at the annual meeting of the Saxony Electrical Works Co., held at Dresden on April 24th, the chairman mentioned that the company began the new year (1922) with orders on hand of the value of 167 millions of marks, as compared with 82 millions at the opening of 1921. The value of the orders increased to 259 millions in February, to 380 millions in March, and to 470 millions of marks in April, 1922.

Tasmanian Hydro-Electric Developments.—Sir Francis Newdegate, Governor of Western Australia, who is on leave in this country, stated in a Press interview on Saturday that in Tasmania, of which he was Governor when eight years ago he went to Australasia, there was great scope for hydro-electric development. The water supply from the great lakes in the middle of the island was harnessed, and wonderfully cheap electric power was the result. Because of this cheapness there was every indication that Tasmania would become a great manufacturing centre. For some time past there had been considerable factory development.

A Continental Cable Trade Agreement.—It was recently mentioned that the Felten & Guilleaume Co., of Cologne, had succeeded in regaining the share majority control over the companies of the same name in Vienna and Budapest. It may now be added that arrangements have been made between the companies for the mutual interchange of patents and experience, and that the markets in Austria and Jugo-Slavia have been reserved to the Austrian and Hungarian companies and the new cable company formed at Neusatz, while the companies will act jointly with regard to oversea and other export markets.

LIGHTING AND POWER NOTES.

Argentina.—Hydro-Electric Works.—It is reported from Buenos Aires that as a result of arrangements made with the Government of Brazil, work will shortly be begun in connection with the utilisation of the falls of the Iguassu. The initial plant is to be capable of developing 150,000 h.p.; this will subsequently be increased to 300,000 h.p. It is proposed to transmit the power to Buenos Aires and intermediate places by means of a quadruple transmission line. The import duties on the electrical machinery required have been reduced to facilitate the procuring of the plant from abroad.

Barrow.—Extension of Supply.—The electrical engineer has been instructed to apply to the Electricity Commissioners for sanction to proceed with the projected electricity supply to Dalton, Ulverston, and Rampside.

Barnstaple.—LOANS SANCTIONED.—The Town Council has received sanction to loans of £2,100 for condensing plant at the electricity works, and £1,500 for mains, services, and meters. The charge for electricity for lighting has been reduced to 9d. per unit, and for power to 7d.

Bedford.—ASH-HANDLING INVENTION.—At a meeting of the Electricity Committee it was reported that Messrs. R. W. L. Phillips and J. R. Blaikie had patented an invention for removing clinker from the boiler-house and were prepared to license the Council to use such invention without fee. The Committee recommended that the offer be accepted with the thanks of the Council.

Brighton.—ELECTRICITY SUPPLY.—Owing to developments in the district the Corporation has decided to discontinue the supply of electricity to Aldrington. The load is to be transferred to the Hove generating station.

Camborne.—PROPOSED CHANGE-OVER.—The Urban District Council has received an application from the Urban Electric Supply Co. for consent to change the existing system of electricity supply from d.c., lighting 240 V, and power 480 V, to a.c. at the same voltages and a frequency of 25 cycles. The application has been referred to the Highways Committee.

Chester.—INQUIRY.—At a public inquiry held recently, an inspector appointed by the Electricity Commissioners heard objections made by the Flintshire and Hawarden Rural Councils to the proposal of the Chester Corporation to supply electricity within the Rural District of Hoole and parts of the Rural Districts of Chester, Tarvin, and Hawarden. Mr. S. E. Britton, electrical engineer to the Chester Corporation, gave evidence to the effect that it was essential, if the Corporation was to be enabled to give cheap supplies from its power station in Chester and the power station at H.M. factory at Queensferry, that the area of distribution should be much wider than it was at present and as large as circumstances would allow.

Continental.—HOLLAND.—The Dutch Government has nominated a commission to carry out a general scheme of electrification, the plans for which have already been drawn up. It is proposed to set up five large stations, which will replace the large number of small installations now working. The five stations will be linked up by a 50,000-volt cable. There will be a double distribution network on a special system. Up to the present it has been decided that the stations will be at Amsterdam, Rotterdam and South Brabant, and the fourth will possibly be situated on the Dutch coalfield.

BELGIUM.—The delegates of the communes of the cantons of Somergem and Nevele, East Flanders, at a recent meeting decided to set up a joint undertaking for the supply of electricity in the districts concerned. It was settled that the central station should be erected at Aeltre, and the service Technique Provincial was instructed to prepare the plans.

FRANCE.—The work of reconstructing the power station of the Société des Tramways de Lille is now practically completed; the remaining work comprises the installation of a 3,000-kW turbo-alternator; when this is completed the station will not only be able to supply all the requirements of the tramways, but also those of private consumers.

Douglas (I. of M.).—ELECTRICITY SUPPLY.—A special Electricity Committee has considered letters from Messrs. Handcock & Dykes, enclosing particulars of the system for the supply of electrical energy for the approval of Tynwald, under the terms of Section 9 of the Douglas Corporation Electric Light Act. The estimated expenditure, including the site, &c., is £62,050. The Corporation has applied for sanction to borrow this amount, and the application has been remitted by Tynwald to a Committee for consideration. Under the Act the area is to be lighted by electricity within two years, but the scheme is being held up pending the approval of the Tynwald Council.

Dundee.—HYDRO-ELECTRIC SCHEME.—The Town Council on April 27th considered a new phase in the situation connected with the negotiations between the Corporation and the Hydro-Electric Development Co., Ltd. The Council agreed, in view of the offer of the company to exclude Dundee from its Bill, that the city's opposition to the Bill should be withdrawn provided the company undertook not to lay its cables through Dundee; and that the permission to electrify traction should be limited to the electrification of main-line railways.

Formby.—ELECTRICITY SUPPLY.—The Urban District Council has decided to engage an expert to prepare a scheme for the supply of electricity to the district. It was stated at the meeting of the U.D.C. that some time ago, when the Lancashire & Yorkshire Railway Co. was approached with reference to supplying electricity from its power station at Formby, the company stated it had no powers to supply electricity, but that the L. & N.W. Railway Co., which now controlled the Lancashire & Yorkshire Railway Co., had powers.

Glasgow.—ELECTRICITY FOR INDUSTRIAL PURPOSES.—The manager recently reported to the Corporation Electricity Committee that he had been in communication with the Electrical Contractors' Association regarding the question of hiring-out electric motors for manufacturing and industrial purposes, and the matter had been left in his hands. It has been remitted to the Sub-Committee on Propaganda to consider the question of making an active canvass with the view of encouraging the use of electricity for industrial purposes.

Liverpool.—PROPOSED TRANSFER OF UNDERTAKING.—The Liverpool District Lighting Co.'s electricity plant at Waterloo is to be acquired by the Corporation, and a deputation representing the Urban District Councils of Waterloo-with-Seaforth and Great Crosby recently met the Corporation Electricity Committee to ask for preferential terms as a condition of consent to the extension of the Liverpool supply area to Bootle, Litherland, Waterloo, and Crosby. The offer of the Electricity Committee was that there should be an immediate reduction of the present charge of 9d. The reduced charge would be 8½d., and as prices declined in Liverpool, so Waterloo and Crosby would benefit. The deputation declined the offer.

Luton.—LOANS.—In connection with a supply of electricity in bulk from the North Metropolitan Electric Power Supply Co., the Town Council is applying for loans of £3,733 for transformers and switchgear, and £8,267 for cables.

Lynn.—LOAN.—Application is to be made to the Electricity Commissioners for sanction to the borrowing of £10,000 for electricity purposes.

Menai Bridge.—PROPOSED PURCHASE OF UNDERTAKING.—The Urban District Council is negotiating with the Electricity Supply Co. for the purchase of its undertaking.

Navan.—INQUIRY.—Mr. M. Ryan has conducted an inquiry into the proposal of the U.D.C. to carry out an electric lighting scheme in the town, at an estimated cost of £9,900. There was no opposition from the ratepayers.

Porthcawl.—ELECTRICITY SUPPLY.—At a recent meeting of the Council Mr. D. J. Rees proposed that the Council should employ a consulting electrical engineer to report upon the advisability of installing plant for the electric lighting of the town. He outlined a scheme, the total cost of which would be approximately £10,000. The proposal was supported by several members, and the Council appointed a sub-committee to examine the scheme and report.

Rochdale.—ELECTRICITY IN BULK.—An agreement has been arranged between the Corporation and the Bury Electricity Committee whereby Bury will furnish the Corporation with a bulk supply of electricity.

Royton (Oldham).—ELECTRICITY SUPPLY.—The General Purposes Committee of the U.D.C. has appointed a sub-committee to confer with the Crompton U.D.C. with reference to a scheme for the supply of electricity to the district.

South Africa.—ROBERTSON.—The ratepayers have authorised the Municipality to raise a loan not exceeding £25,000 for the purpose of carrying out an electric lighting scheme prepared by Mr. Charles G. Trevett, consulting engineer.

Southport.—PROPOSED EXTENSIONS.—According to a report prepared by Mr. E. MOXON, the borough electrical engineer, nearly £70,000 is required for the purpose of extensions and alterations at the electricity works. He recommends the installation of a 1,500-kW three-phase turbo-alternator. The total estimated expenditure on mains and equipment, inclusive of requirements for services and meters, is given at £38,730, and the estimated expenditure on new generating plant is shown at £31,150.

The Finance Committee has instructed the Town Clerk to make application to the Electricity Commissioners for sanction to borrow £69,000 for the proposed extensions.

Walden.—ELECTRICITY SUPPLY.—The Town Council has appointed a committee to prepare a report as to the expediency of installing electric lighting in the borough. A Provisional Order was granted to the Council before 1914, but during the war period further progress was prevented.

Warrington.—PRICE REDUCTIONS.—The Electricity Committee is reducing the price of electricity by 20 per cent. for power and heating, and by 10 per cent. for lighting and traction.

TRAMWAY AND RAILWAY NOTES.

Continental.—HOLLAND.—In connection with the scheme for erecting power stations in various cities it is proposed to electrify the railway of the Izeren Spoorweg Maatschappij, the plans for which were drawn up in 1918. The next are the secondary lines which, with the State railways, are now the subjects of survey, as regards both their lines and materials. Overhead transmission will be preferred to the third rail, owing to the characteristics of the ground. The power station which will supply electricity for the railways will be set up at Leidchen Dam, to the east of the Hague, and will have a capacity of 30,000 kW. The electrification of existing steam tramway lines is also to be carried out. The concession for the conversion of the Gooische tramway is expected to be granted this year. The conversion of the line

has just been completed and the erection of the power station begun. On the other hand, the Zeeuwsch Vlaamsche Tramweg Maatschappij at Axel, in Zeeland, proposes to set up in this province a new line of tramways with stations, depôts, and sheds. The works are to be started this year.

ITALY.—By a Ministerial Decree the electrification of the Voghera-Piacenza line is to be taken in hand at once. When this is finished the lines terminating at Piacenza will be completed. Tenders are now being invited for the several branch lines of the Milan-Bologna section. The electrification of the Napoli-Reggio Calabria line has just received the sanction of the Consiglio Superiore delle Acque and the work will be started shortly.

Glasgow.—PROPOSED PURCHASE OF UNDERTAKING.—The Corporation Tramways Committee has recommended the Corporation to offer £250,000 for the acquisition of the undertaking of the Paisley District Tramway Co.

Halifax.—NEW TRACK.—The Tramways Committee proposes to apply to the Ministry of Transport for sanction to the construction of an extra loop and the doubling of the tramway between Cousin Lane and Pharoah Lane, Illingworth.

Leeds.—TRANSPORT OF COAL.—The Tramways Committee has under consideration a proposal to use the tramways for transporting coal direct from the collieries near the city to the big works in the district.

TRAILER CARS.—It is also proposed to introduce trailer cars, and a deputation is to visit London to see trailers in use.

London.—THROUGH SERVICES.—A through service of the L.C.C. tramcars from Victoria Embankment to Wimbledon Hill and to Kew Bridge was commenced last Tuesday. The fare at mid-day between the Embankment and Hammersmith Broadway to Kew Bridge will be 5d.

Luton.—EXTENSION OF TIME.—The Town Council has applied for an extension of time until August 11th, 1923, for completion of the work authorised by the Tramways Order, 1905.

Newport.—SUNDAY SERVICES.—In order to meet the competition of the motor 'buses the Tramways Committee has recommended the Corporation to inaugurate Sunday tramcar services.

Rhondda.—PROPOSED AMALGAMATION.—The Tramways Company has invited the Urban District Council to send representatives to an inquiry to be held at Pontypridd shortly by the Pontypridd U.D.C. and the Rhondda Tramways Co. into a proposed joint service of cars from Pontypridd to Tonypandy and Treherbert. A joint system is already in operation in the Rhondda Foch Valley from Pontypridd to Ferndale, and has proved successful. The Rhondda Council has decided to be represented at the Convention.

TELEGRAPH AND TELEPHONE NOTES.

Australasia.—WIRELESS TELEPHONY.—In its wireless telephony tests on March 10th last the Australian Postal Department established communication with New Zealand, this being the first occasion on which this has been accomplished in Australasia.

Austria.—WIRELESS TELEGRAPHY.—An Austrian wireless company has been chartered with a capital of 250,000,000 kronen, furnished by the Siemens-Schuckert Telefunken Companies and the Vienna Bankverein service connected with the Berlin Telefunken. Existing Austrian stations are to be enlarged to enable direct wireless service with all Europe and America to be furnished.—*Financial Times.*

China.—PEKING-HARBIN TELEPHONE.—The Chinese Ministry of Communications has completed the survey of the long-distance telephone route between Peking and Harbin. The Ministry is making preparations to start work, and has signed a contract for the purchase of the necessary materials from the China Electricity Co. Work was to be begun during March and was to be finished in May.—*Reuter's Trade Service* (Shanghai).

Irish Free State.—TELEGRAPH SERVICE.—The Irish Post Office has made arrangements with the Commercial Cable Co., Waterville, and the Marconi Wireless Co., Clifden, to handle Irish traffic for America at Irish stations, and thus avoid routing the messages *via* London.—*Westminster Gazette.*

Italy.—NEW CABLES.—A decree published in Italy confirms the agreement between the Italian Government and the Compagnia Italiana dei Cavi Telegrafici Sottomarini to lay a cable, the work to be finished within three years, connecting Italy with South America, and another cable, the work to be finished within two years, connecting Italy with Greece.—*T. & T. Age.*

Mexico.—WIRLESS TELEGRAPHY.—The Marconi Co. has proposed to the Mexican Government a scheme whereby the company would control for fifty years all wireless stations built or to be built on Mexican territory. After the expiration of the fifty years the wireless stations would be turned over to the Government or the concession renewed. The Government regards the offer in its present form as unacceptable, but it is believed would be prepared to give it favourable consideration if modified.—*Financial News.*

Switzerland.—NEW WIRELESS STATION.—The Swiss Marconi wireless station was formally opened at Munchen Buchseo, near Berne, on April 26th. Dr. Furrer, Director-General of the Swiss Telegraph Administration, expressed the hope that the Swiss station would develop in such a way as to be able to communicate also with far-distant oversea stations.—*Financial Times.*

The Telephone Service.—LEEDS AUTOMATIC EXCHANGE.—When recently addressing the Leeds Chamber of Commerce Sir William Noble, engineer-in-chief of the G.P.O., said that in the local auto-exchange service well over 30,000 calls were originating per day. The original equipment provided for 6,800 subscribers' lines, with an ultimate capacity for 15,000 lines. Three to four thousand automatic dial calls were dealt with daily in the Leeds local area. In 1921 an order was placed for an extension of the automatic plant, comprising equipment for 2,600 additional lines, bringing the fitted capacity of the exchange up to 9,600 lines. Dialling out to the sub-exchanges in the Leeds area is proposed, and it will give direct communication with Headingley, Roundhay, Chapeltown, Stanningley, Morley, Rothwell, Horsforth, and Crossgates. The next and most important step in the development of the Leeds area for automatic communication will be the conversion of the sub-exchanges to full automatic working, thus dispensing altogether with manual operation of the local area traffic. Schemes to effect this are already in hand for Roundhay, Chapeltown, Headingley, and Stanningley. In England the Post Office had tried to popularise the party system, but had not met with success. The farmers did not respond to the idea, although advantageous terms had been offered to them.

NEW CALL BOXES.—The Post Office, as an experiment, has installed at Charing Cross Railway Station four "automatic" telephone call-boxes, and five more are to be available at the Bank Station. The instruments involve a new method of procedure on the part of the caller. He calls up the exchange by inserting his three pennies in the coin-box, and then gives the number he wants. If he finds he has to wait too long for an answer he can, by pushing a button, labelled "B," get his pennies returned. Should the call be answered the caller hears the subscriber speak, but cannot himself be heard until he pushes button "A." The depression of this button transfers the coins into another channel, and completes the circuit between caller and subscriber. The Post Office claims that the system saves time and eliminates the feverish ringing of callers who think they are being kept waiting too long. —*The Times.*

REDUCED CHARGES.—Sir Robert Horne, Chancellor of the Exchequer, announced in his Budget speech in the House of Commons on Monday that the telephone service charges would be reduced. The estimated revenue included: Telegraphs, £5,230,000, or £670,000 less than last year. Telephones, £13,728,000, or £3,228,000 more than last year. The Postmaster-General (Mr. Kellaway) was to give precise details of the proposed reductions in the House yesterday.

GRIMSBY AUTOMATIC EXCHANGE.—The Grimsby exchange, which was the first complete automatic installation in the country, is to be equipped this month with an extension providing 550 additional lines. A new underground cable between Grimsby and Hull is being laid, which will greatly increase the facilities for communication between the two places and greatly reduce the risk of interruption through storms or breakdowns due to atmospheric conditions.

United States.—TELEGRAPH SUIT WITHDRAWN.—The United States Attorney-General has decided to withdraw the Government's suit against the Postal Telegraph Co. to control the latter's turnover and its war-time earnings of $4,000,000, and accept in return a sum of $1,680,000, as compensation.—*Financial News.*

Wireless Telegraphy.—INTERNATIONAL CONFERENCE.—The Commercial Radio International Committee, composed of the representatives of the Radio Corporation of America, Compagnie Générale de Télégraphie sans Fil, Gesellschaft fur Drahtlose Telegraphie m.b.H., and Marconi's Wireless Telegraph Co., Ltd., has completed its conference. Developments in different parts of the world of wireless telegraph and telephone communication were considered, and as a result of the agreement between the four companies a number of new international wireless telegraph services will be opened in the early future. It was decided that the companies should not erect and would not view with favour the erection by others of any stations which would entail the harmful radiation outside an agreed radius of harmonics or secondary waves which were beyond the definite wavebands allotted to each particular station.

FUTURE REGULATIONS.—At a conference last week it is said that the final form of future regulations was completed. *The Times* understands that the Wireless Sub-Committee of the Imperial Communications Committee, which has for some time past been hearing and considering the views of Government Departments on the development of wireless facilities in this country, has arrived at certain decisions, which have been approved by Mr. Churchill, the chairman of the main committee.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Aberdare.—Urban District Council Electricity Department. Second-hand 500/700-kW Belliss or other a.c. steam generating set. (See this issue.)

Powell Duffryn Steam Coal Co., Ltd. Copper wire and electrical accessories for three or six months. Stores manager, Aberaman Offices, Aberdare.

Aberdeen.—May 22nd. Electricity Department. Structural steelwork, corrugated iron sheeting, &c., for the new boiler-house at Ferryhill. (See this issue.)

Argentina.—Buenos Aires.—June 28th. Municipal Council. Plant for hydro-electric generating station and transformer sub-station.*

Australia.—Melbourne.—September 1st. Victorian Electricity Commissioners. Five surface feed-water heaters, six surface vapour condensers, and 12 feed-water evaporators.

October 17th. Postmaster-General's Department. Supply of automatic switchboards and associated apparatus for two suburban exchanges at Melbourne.

In connection with the scheme to grant relief to thousands of unsatisfied applicants for telephones, the Postmaster-General is placing orders, and is about to invite tenders for large supplies of material, including British cables and insulated wire, involving an outlay of £2,000,000.—*Reuter's Trade Service* (Melbourne).

Sydney.—May 29th. Department of Public Works. One 1,000-kW steam turbo-generator, complete with fittings and accessories, for the State power house at Uhr's Point.*

Bradford.—May 9th. Corporation. Electric light installations, housing scheme No. 3, Bradford Moor, 20 houses; scheme No. 4, Scholemoor, 100 houses. City architect, Town Hall.

Bulgaria.—May 10th. State Mining Department. Machinery and plant, for the Bulgarian State Mines.*

Doncaster.—May 8th. Electricity Department. Two water-tube boilers, with economisers, induced draught plant, and steel chimney. (April 21st.)

Dorchester.—May 24th. Electricity Department. One vertical gas engine direct coupled to 1,000-kW d.c. generator, with gas producer plant, pipework, auxiliaries, &c. (See this issue.)

Dundalk.—May 16th. Electricity Department. One 340-kW Diesel generator, one 100-kW motor generator, one 50-kW balancer, switchgear, &c.; replating 500-V storage battery. (See this issue.)

Eccles.—May 8th.—Town Council. Supply and erection of overhead distributing mains for 200 houses on the Anson Street housing site. Borough electrical engineer, Cawdor Street, Patricroft.

Edinburgh.—May 15th. Electricity Department. Six or 12 months' supply of electricity meters. (April 28th.)

Tramways Department. Steel rails, fishplates, trucks, electric welding plant, &c. The Manager.

Egypt.—Alexandria.—June 1st. Ports and Lights Administration. The Arsenal. Six months' supply of general stores, including electrical gear, &c.

Fleetwood.—May 9th. Electricity Department. One 1,000-kW d.c. turbo set, with switchgear and condenser. (April 28th.)

India.—May 26th. High Commissioner's Department. Insulator cups, porcelain or glass. (See this issue.)

London.—Paddington.—May 15th. Great Western Railway. Three or six months' supply of stores, including telegraph instruments, electrical apparatus, lamps, &c. (See this issue.)

Bethnal Green.—May 16th. Board of Guardians. Installation of a telephone switchboard and instruments at the hospital, Cambridge Road, E.2. (See this issue.)

Hackney.—June 14th. Electricity Committee. Pipework and valves. (See this issue.)

Stepney.—June 8th. Electricity Supply Department. Three water-tube boilers, with chimneys, economisers, and accessories; two 10,000-kW turbo-alternators with condensers, accessories, and switchgear. (See this issue.)

H.M. Office of Works.—May 19th. Ironfounders' and smiths' work, electrical labour in day work, and mechanical labour in daywork, in the Windsor district. (See this issue.)

Manchester.—May 9th. Tramways Committee. Trucks for tramcars. Mr. J. M. McElroy, general manager.

May 23rd.—Electricity Committee. Electrical storage batteries, for Barton power station. One 120-cell battery, capacity 600 amp. for one hour; one 120-cell battery, capacity 300 amp.-hours at 1.10 hr. rate. (See this issue.)

Morocco.—Rabat.—May 27th. Postal Department. Supply of bronze and copper wire, in two lots, deliverable by October 1st, also porcelain insulators, in two lots, for the postal service. Particulars from the Office des Postes, Télégraphes, et Téléphones, at Rabat, Morocco.

Mountain Ash.—May 8th. Urban District Council. E.h.p. overhead and underground transmission mains. (April 28th.)

Preston.—May 30th. Electricity Department. Two 10,000/12,000-kW turbo-generator sets, with condensing plant, auxiliaries, and piping; house-service plant, comprising one 1,200-kW turbo-generator and two a.c. 6,600/220-V d.c. sets.

South Africa.—April 28th.—Electrification of Glencoe-Pietermaritzburg Section.—June 29th. South African Railways and Harbours Board. Steel-frame buildings for power station. Specifications and forms of tender from the High Commissioner of the Union of South Africa, Trafalgar Square, W.C.2.

Warrington.—May 13th. Gas Department. For laying cable and altering switchboard for the Corporation Gas Department. Particulars from Mr. W. S. Haddock, general manager.

May 15th. Electricity Department. E.h.p. sub-station ironclad switchgear. (See this issue.)

*A copy of the plan, specifications, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Australia.—Melbourne.—City Council Electricity Department. Accepted:—

2,200 yd. 1.25 sq. in. single conductor lead-covered cable (£1,833).—W. T. Henley's Telegraph Works Co., Ltd.
Three 500-kVA transformers (£1,506).—Metropolitan-Vickers Electrical Co., Ltd.
One electrically-driven air compressor (£171).—Homewood & O'Neill.
One 2,000-kW rotary converter (£8,133).—Metropolitan-Vickers Electrical Co., Ltd.
Steel doors and plates for h.p. switch cubicles (£676).—Johnston & Ashton.
Insulated copper cables (£465, approx.).—W. T. Henley's Telegraph Works Co., Ltd.

Subiaco (W.A.).—Municipal Council. Accepted:—

Transformers (£2,404).—Geo. Wills & Co.
Switchgear and h. and l.p. apparatus (£2,522).—British General Electric Co., Ltd.—*Tenders.*

Bath.—Electricity Committee. Accepted:—

Patent self-cleaning band screen (£998), for the condensing water intake chamber.—F. W. Brackett & Co., Ltd.
Laying mains to Tiverton (£6,078).—Callender's Cable and Construction Co., Ltd.

Bolton.—Electricity Department. Accepted:—

Electrical installation at the new picture house, St. George's Road.—Mr. G. H. Blackburn.

Bridgend.—Electricity Department. Accepted:—

High-speed turbine engine connected to 2-phase alternator (£3,443).—W. H. Allen, Sons & Co. The plant has an output capacity of 500 kW and capability of overload of 25 per cent.

Cheadle and Gatley.—Urban Council. Accepted:—

Cables for the electricity scheme (£18,737).—Macintosh Cable Co., Ltd.

Glasgow.—Tramways Committee. Recommended:—

Cable.—Western Electric Co., Ltd.; and Pirelli-General Cable Works, Ltd.
Globe strain insulators.—British Insulated & Helsby Cables, Ltd.

London.—St. Marylebone.—Electric Supply Committee. The Committee recommends the following additional payments in connection with the undermentioned contracts, due to increased costs of manufacture, material, &c.:—

Boilers, £1,194 (making £4,944).—Babcock & Wilcox, Ltd.
8,000-kW turbo-alternator (£976).—Oerlikon Co., Ltd.
Water-cooling towers (£341).—Clyne Engineering Co., Ltd.

Salford.—Electricity Committee. Accepted:—

Maintenance and calibration of the automatic coal-weighing machine for 12 months (£100).—W. & T. Avery, Ltd.
Two 6,600-V switch cubicles for sub-stations (£450). One e.h.p. ditto, for supply at Pendleton (£325).—Metropolitan-Vickers Electrical Co., Ltd.

Transmutation of Metal.—The discovery of turning metal into helium gas, described recently in the *Daily Mail* as having been made in the United States, has been made also in this country, says the same journal. Mr. H. F. Fratton and his colleague, Mr. E. S. Pangbourne, last December discharged a current at 81,650 volts into an electric lamp enclosed in an exhausted vessel, and the lamp burst, with evidence of intense heat and light evolution. Analysis of the contents of the vacuum cylinder, they say, showed that no trace of the original tungsten filament of the lamp remained, but a gas was evolved consisting of neon, argon, and a third elementary gas so far not identified.

FORTHCOMING EVENTS.

Association of Engineers-in-Charge.—Saturday, May 6th. At St. Bride's Institute, Bride Lane, E.C. At 7.30 p.m. Informal discussion on "Uniflow v. Multiple Expansion Steam Engines."

London Association of Foremen-Engineers.—Saturday, May 6th. At Cannon Street Hotel. At 6 p.m. Sixty-ninth anniversary festival.

Electrical Power Engineers' Association (Kent Section).—Saturday, May 6th. At Slessati's Restaurant, Rendezvous Street, Folkestone. At 3 p.m. General meeting.

Institute of Transport.—Monday, May 8th. At the Institution of Civil Engineers, Great George Street, S.W. At 5.30 p.m. Paper on "Recent Improvements in Equipment for Electric Traction on Railways Making for Economy," by Mr. R. T. Smith.

Electricity Supply Commercial Association.—Tuesday, May 9th. At Wortley Hall, Seven Sisters Road, N. At 7.30 p.m. Address by Mr. G. R. Smith, general secretary.

Institution of Electrical Engineers (Liverpool Sub-Centre).—Monday, May 8th. At the Compton Hotel, Church Street, Liverpool. At 7 p.m. Annual general meeting and smoking concert.

(East-Midland Sub-Centre).—Tuesday, May 9th. At the College, Loughborough. At 6.45 p.m. Annual general meeting.

Society of Technical Engineers (South-Eastern District).—Wednesday, May 10th. At the Institution of Electrical Engineers, Victoria Embankment. At 7 p.m. Lecture on "An Engineering Tour in India," by Dr. J. F. Crowley.

Institution of Mechanical Engineers (North-Western Branch).—Thursday, May 11th. At the Manchester College of Technology. At 7 p.m. Lecture on "Tanks and Chain-track Artillery," by Mr. L. A. Legros.

Optical Society.—Thursday, May 11th. At the Imperial College of Science. At 7.30 p.m. Discussion on Motor-car Headlights."

Physical Society of London.—Friday, May 12th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary meeting.

Royal Institution of Great Britain.—Saturday, May 13th. At Albemarle Street, W. At 3 p.m. Lecture on "The Disappearing Gap between the X-Ray and Ultra-Violet Spectra. (I) Grating Results," by Prof. O. W. Richardson, F.R.S.

NOTES.

The Lock-out.—The lock-out notices not having been suspended they took effect, in respect of the 47 unions, on Tuesday. The inquiry by Sir William Mackenzie was opened on Wednesday. It was open to the Press, but there was no accommodation available for the general public. The employers opened their works to men willing to accept employment on individual contracts which involved acceptance of the employers' three conditions of managerial control.

Miners' Nystagmus.—The first report of the Miners' Nystagmus Committee of the Medical Research Committee has just been issued (H.M. Stationery Office. Price 1s. 6d. net). While the report is, of course, written chiefly from the optico-medical point of view, there are a number of items which come within our scope. In an introduction to the report it is stated that the Committee is agreed in fixing the blame for nystagmus principally upon deficient illumination. In the case of electric lamps this is generally brought about by the reduction of the voltage as the battery nears exhaustion, but another cause is the obscuration of the glasses by coal-dust and dirt. Conditions are considerably improved by the use of electric cap lamps, where illumination is brought to bear directly on the work without impairing the miner's vision. In Section E, which deals particularly with illumination, it is said that the disease is common in Belgium, France, and Germany, where safety lamps are almost universally used. In the United States, where open lights and electric cap lamps are employed, the disease is very uncommon, and the same is the case in Japan, where the general method of lighting is by acetylene. A great deal of photometric data is given, and it is reported that the introduction of the electric lamp has improved the general illumination. Dissatisfaction is expressed at the variation of the quality of lamps of the same type—chiefly due to bad bulbs; an example is quoted in which two cap lamps, ostensibly identical, gave readings of 1.4 and .8 candle-power respectively. Photometric readings show that the cap lamp often gives from ten to twenty times more illumination upon the working area than an oil or electric lamp; the cap lamp is so much nearer the work, and its rays fall at right angles, and not obliquely. The committee alleges that much discredit has been brought to the electric lamp industry by the inferior lamps supplied by some makers, which have failed under the stress of pit work.

Fire.—On April 22nd a fire broke out at the Gowanbank Ironworks, Falkirk, owned by Messrs. Cockburn & Co., Ltd. Damage to the extent of several thousands of pounds was caused, a large and valuable stock of electric stoves being destroyed.

Appointment Vacant.—Winder (300 taels per month, tael = 3s.) for the Shanghai Municipal Council Electricity Department. (See our advertisement columns to-day.)

Generating Plant in the United States.—According to the *Electrical World*, on October 1st, 1921, there were 5,532 central generating stations in the United States, with a total installed generator rating of 14,466,915 kW. The increase from January 1st, 1920, was 1,706,015 kW, or 7.6 per cent. per annum. Out of the former total the amount of reserve equipment was 169,577 kW. Nearly 65 per cent. of the stations are privately owned.

Telephone Extensions.—A considerable development and extension of the telephone system in Great Britain involving the expenditure of £9,500,000 out of capital, is projected for the current financial year. The chief items will be as follows, says *The Times*:—

£2,230,000 on trunk works, including the extension of the "backbone" trunk system, by the provision of underground ducts and cables. £343,000 for extension of the overhead service. £3,500,000 for local works, the provision of subscribers' circuits, junction lines, and public call offices. £2,250,000 for new exchanges and the extension of existing exchanges, including sites and buildings. The construction of two long underground routes will be put in hand, namely, from Leeds to Edinburgh *via* Darlington, Newcastle, and Jedburgh, and from Worcester to Bristol *via* Gloucester. The Leeds to Edinburgh cable will complete the main underground route between London and Scotland, and the Worcester to Bristol cable will provide communication between Birmingham and Bristol. Among the shorter and more important extensions of the existing underground system which will be begun or completed during the financial year are the following new routes:—London to Southend, Bristol to Bath, Manchester to Preston, Preston to Lancaster, Bradford to Dewsbury, Colchester to Ipswich, Pontypool to Abergavenny, Swansea to Pontardawe, Glasgow to Whitecraig, Kirkintilloch and Kilsyth and Edinburgh to Kirkcaldy.

The new overhead trunk circuits will number about 200 and will, in some instances, increase the capacity of the existing routes, and in other cases, such as Bristol to Oxford, Exeter to Yeovil, and Nottingham to King's Lynn, will create new direct routes by the elimination of intermediate switching points. In connection with the local development works, underground ducts and cables will be laid in a large number of towns. The scheme for new exchanges and the extension of existing exchanges includes the installation of equipment for about 30 new exchanges and for the extension of some 40 of the more important existing exchanges. A new exchange is to be provided in Central London near the Monument and the work is to be begun at once. In the outer suburbs exchanges will shortly be opened at Tottenham and Barnet, and equipment is to be provided for new exchanges at Eltham, Kilburn, Southall, Nunhead, Woodford, Wallington, Addiscombe, Thorton Heath, and Hounslow. In the country the work will include new exchanges at Ramsgate, Eastbourne, Southampton, Swansea, Birmingham, Sheffield, Buxton, Liverpool, Inverness, and Dundee.

Provision is made in the year's work for a considerable extension of the automatic telephone system in the working of the new exchanges at Southampton, Gloucester, Swansea, Sheffield, Shrewsbury, Fleetwood, Dundee, and Kirkcaldy, all of which will be equipped with automatic plant. The equipment will also be extended at the automatic exchanges already existing at Epsom, Newport (Mon.), Chepstow, Leeds, Accrington, and Darlington. It is claimed that the proportion of subscribers served by the automatic system is greater than that of any other telephone administration in the world. Leeds, with some 6,000 subscribers on the automatic system, is the largest automatic exchange in this country, and Hurley, near Marlow, with 19, is the smallest. While conditions are not anything like normal, the telephone industry is experiencing less difficulty in obtaining its raw material than was the case 12 months or so ago.

Electric Cranes in a Shipyard.—The new "East Yard" at Dalmuir of Messrs. William Beardmore & Co., Ltd., which covers an area of 12 acres, contains four building berths, which are served by four electrically-driven Toplis cantilever cranes, arranged in pairs between the berths. One of each pair spans both bows in the berths on either side, and the other both sterns. The working radius of each crane is 105 ft. The yard is self-contained, having its own power-house, &c.

Electric Farming.—As reported in the daily Press, Mr. A. T. Davies, M.P., recently raised the question of the application of electricity to agriculture. In reply to his question as to the present position of electric farming, the Minister of Agriculture is reported to have stated: "The Ministry was in close touch with a gentleman who was applying electricity and they had had the benefit of the data derived from his own experiments. Some of his results had already been published, and the Ministry had arranged for them to be summarised and published in the Ministry's *Journal* for the benefit of farmers in general." It will doubtless interest our readers to know (if they have not already guessed as much), that the reference is to the work of Mr. R. Borlase Matthews. An abstract of his paper on the applications of electricity to agriculture, read before the Institution of Electrical Engineers, was given recently in our columns, thus to some extent forestalling the *Journal* of the Ministry of Agriculture.

The Electrical Engineers' Ball, 1922.—It is very satisfactory to learn that, owing to the splendid response to the invitations issued by the Committee for the last dance (held on February 10th), the General Committee was able to hand a sum of 55 guineas to the Institution of Electrical Engineers' Benevolent Fund, and 55 guineas to the Electrical Trades Benevolent Institution.

Fatality.—Whilst working on a condenser tower at Blackpool Electricity Works, on April 27th, Ralph Curran (34), fell a distance of 50 ft., and was killed.

Electric Vehicles in New Zealand.—During last year 26 electric commercial motor vehicles, valued at £10,587, were imported into New Zealand. Only one vehicle was British, the remainder being American.

INSTITUTION NOTES.

Institution of Electrical Engineers.—Nominations for Council.—The ballot papers for the election of members of Council, which have to be returned by May 8th, contain, in addition to the Council's nominations, the following names, put forward from outside:—

Ordinary Members of Council: Mr. R. A. Chattock, city electrical engineer, Birmingham.

Mr. R. H. Fletcher, B.A., consulting electrical and mechanical engineer, Cardiff.

Mr. A. M. Sillar, consulting engineer, Westminster.

Associate Members of Council: Mr. A. F. Harmer, power superintendent, Metropolitan Electric Supply Co., Ltd., London.

The list of nominations by the Council was published in our issue of April 7th, and then showed three nominations for three vacancies in the class of Associate Members. It happened, however, that Mr. A. B. Hart, one of these nominees, was transferred to full membership and thus became ineligible for election in the former class. Consequently Mr. Hart's name now appears in the list of nominations for the Member class, Mr. Harmer takes his place, and there will be no ballot for the class of Associate Member; but there are nine nominations for three vacancies in the senior class.

Western Centre.—The chairman (Mr. A. C. MacWhirter) presided over a meeting held on May 1st. The joint hon. secretary (Mr. C. T. Allan) reported that the membership roll stood at 487, being an addition of four since the last meeting. It was announced that a summer meeting would be held in the neighbourhood of the Stroud Valley. Mr. James Anderson read his paper on "Electric Motor Starters," illustrated by lantern slides. At the close of the paper a discussion of a highly technical nature ensued, to which Major Amberton, Major David, and Messrs. H. Ellis, C. Morley-New, T. Hood, Llewellyn Hughes, J. W. Fidoe, J. B. G. Lewis, C. T. Allan, and the chairman contributed.

North-Western Centre.—The annual general meeting was held at Manchester on April 25th, Alderman W. Walker presiding. The Committee's report for the year showed that eleven meetings were held, three being of an informal character. The membership had continued to increase, the aggregate number of members, associates and students being now 1,333, which compared with 1,214, 984, and 833 in the last three years. Regret was expressed that, after three years' service, Mr. A. G. Ellis had found himself obliged to relinquish the office of secretary. On the recommendation of the Council, Mr. A. L. Green, the assistant secretary, had been elected an Honorary Associate of the Institution in recognition of his 21 years' service with the N.W. Centre. For the Benevolent Fund £109 had been collected, of which £44 was contributed by the Liverpool Sub-Centre, which, founded in 1919, continued to make good progress, the membership being now 449. The Students' Section had held eight meetings.

Mr. Watson moved the adoption of the report, and Mr. Medlyn having seconded, the report was unanimously approved. Thanks were voted to Alderman Walker and to Mr. Ellis for their services.

Mr. J. Frith made an appeal on behalf of the Benevolent Fund.

The officers for the next session were appointed as follows: *Chairman*: Mr. A. S. Barnard; *Vice-Chairmen*: Messrs. G. A. Juhlin and H. C. Lamb; *Honorary Secretary*: Mr. W. A. Coates; *Committee*: Messrs. Ellis, Mallinson, Medlyn, and Pearce.

A lecture upon "Electrical Engineering Advertising" was delivered by Mr. J. W. Beauchamp, director of the Electrical Development Association. He said it had been proved that it was worth while to expend a reasonable amount, contributed by those associated with an industry, upon advertising schemes which brought its merits before the public in a general way instead of being limited to the products of an individual firm or company. It was difficult to conceive a public service which lent itself better to propaganda than electrical engineering, and if kept free from exaggeration and mere huckstering it could be made of educational value as well as profitable. Electricity appealed to the popular imagination, and its use was an indication of the state of civilisation reached by the community, if "civilisation" meant the attainment of easy living and a high standard of comfort. But a difficulty in the way of a national scheme of advertising was the difference in the conditions which prevailed in various districts. A very costly advertisement circulating over wide areas could only be immediately effective in those parts where the appeal was supported by reasonable charges for electricity. Neither the supply company nor the manufacturer of electrical apparatus sold the entire article that the consumer required, but only a part. One was apt to forget that the consumer was not looking for electricity itself, but for what it would give him—heat, light, and power—to increase his comfort or save his pocket.

Liverpool Sub-Centre.—The following officers have been nominated for Session 1922-23:—*Chairman*: Mr. B. Welbourn; *Vice-Chairmen*: Messrs. E. M. Hollingsworth and H. H. Harrison; *Hon. Secretary*: Mr. Oscar C. Waygood; *Committee*: Messrs. L. Breach, W. Lang, J. A. Morton, E. Moxon, and F. J. Teago. As the number of nominees corresponds to the number of vacancies, there will be no necessity for a ballot.

Scottish Centre.—Members of the Scottish Centre of the Institution on Friday attended the seventh ordinary meeting of the Institution in Dundee. A busy day was spent in visiting public works. In the evening a paper was read by Prof. S. Parker Smith, entitled "Single- and Three-Phase Alternating-current Commutator Motors with Series and Shunt Characteristics."

Bradford Engineering Society.—Mr. C. E. Allsop, sales manager to the Bradford Corporation Electricity Department, has been re-elected, for a second year of office, president of the Society. Mr. R. D. Spurr is one of the vice-presidents, and the hon. secretary is Prof. G. F. Charnock, head of the Engineering Department of the Technical College.

Association of Mining Electrical Engineers.—Members of the West of Scotland branch of the Association on Saturday last visited the Clydesmill power station, Cambuslang, of the Clyde Valley Electrical Power Co. Office bearers of the branch have been elected as follows:—*President*: Mr. D. Martin, Glasgow; *Vice-Presidents*: Messrs. D. M'Queen and D. L. Frew; *Treasurers*: Messrs. C. L. Brown & Melville, C.A., Glasgow; *Secretary*: Mr. D. S. Baddeley, 50, Wellington Street, Glasgow.

Institution of Engineers, Australia.—Under the auspices of the Institution, a conference of engineers was held in Melbourne in February, which delegates from all parts of the Commonwealth attended. Prof. R. W. Chapman was elected president for the 1922-23 Session, succeeding Mr. W. J. Newbigin, at the second annual meeting held on February 3rd. Among the papers contributed during the conference was one dealing with the Victorian State electricity scheme, by Sir John Monash, chairman of the Victorian Electricity Commission. Mr. E. G. Ritchie, M.Inst.C.E., described the Maroondah Dam, and Mr. W. Stone read a paper on "The Internal Mechanism of Lubrication." The automatic telephone exchange at Collingwood was the subject of a paper by Mr. R. Lawson. Visits were paid by delegates to a number of places of interest, including the Newport power station and railway workshops; the Jolimont workshops and sub-station; and the Melbourne small arms ammunition factory.

Institute of Transport.—In a paper read before the Institute on April 21st, Mr. J. K. Bruce, traffic manager of the L.C.C. tramways, suggested the increasing of the speed of tramcars by the adoption of an improved form of motor. He stated that this would permit the running of 170 fewer cars, resulting in a saving in maintenance of £70,000 per annum.

Royal Institution.—On May 11th, at 3 p.m., Professor F. Keeble delivers the first of two lectures at the Royal Institution on "Plant Sensitiveness"; and on Saturday, May 13th, Professor O. W. Richardson delivers the first of two lectures on the "Disappearing Gap Between the X-ray and the Ultra-Violet Spectra."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.

At a meeting of the Aberdeen Electricity Committee, the convener raised the question of stabilising the electrical engineer's salary. He said that in 1914 the salary was £750, and with bonus it had risen to £1,050. If stabilised the salary should be fixed at £850 at least. According to local reports the matter was heatedly discussed, and the matter was adjourned till the next meeting.

Mr. A. H. Dykes has been elected chairman of the Beckenham Urban District Council for the ensuing year.

Mr. G. P. Roy, M.I.E.E., succeeded Mr. W. Sutherland, V.D., M.I.E.E., as Director-General (Engineering) Posts and Telegraphs, India. Mr. Roy has seen a good deal of service in the Orient, and (says our correspondent) it is apparent that the final appointment comes as a recognition of all that has gone before.

The Finance Committee of the Carlisle City Council recommended that the salaries of the electrical engineer and the assistant electrical engineer be reduced by 10 per cent. The Electricity Committee decided against the reduction in the salary of the electrical engineer, but the City Council on April 26th adopted the recommendation as from October 1st next.

Barnstaple Town Council has referred back for further consideration the recommendation to reduce the salaries and wages of its officials, &c., including the electrical engineer and his assistant.

Major WILLIAM PAXMAN, O.B.E., has been elected to succeed the late Mr. J. N. Paxman as chairman of Davey, Paxman and Co., Ltd., of Colchester.

MR. C. J. BAKER, superintendent of Blackpool Corporation tramways, entered upon his duties as manager of the Ashton-under-Lyne tramways on Monday last. On April 27th his colleagues at Blackpool made him suitable presentations. Councillor H. Brooks, chairman of the Electricity and Tramways Committee, presented him with a cheque from the Electricity and Tramways Employés' Institute (which he was largely instrumental in establishing), and Mr. Chas. Furness, the tramway manager, presented him with an oak grandfather's clock, subscribed for by the tramway employés.

The marriage took place at Chester, on April 26th, of MR. DANIEL JENKINS, M.Sc., district manager for the Swansea area of Metropolitan-Vickers, Ltd., and MISS JANE WHITTINGTON THOMAS, youngest daughter of the late Mr. Robert Thomas, shipowner, Liverpool.

A barometer has been presented to MR. T. F. PATTEN, senior charge engineer, by the power station staff of Messrs. Vickers, Ltd., River Don Works, Sheffield, on the occasion of his marriage.

MR. H. H. OXLEY has resigned the position of London and district manager to Messrs. Mann, Egerton & Co., Ltd., with a view to organising and developing the sale of the Sims light and power plant. Before joining Messrs. Mann, Egerton, Mr. Oxley was on the staff of Messrs. Vickers, Ltd.

Mr. MAX FALK, chairman of Messrs. Falk, Stadelmann and Co., Ltd., has just returned from a six months' trip to Australia, made partly for business reasons, and partly for the benefit of his health. To mark the occasion of his return a dinner was given in his honour, on Saturday last, at Frascati's Restaurant, by the heads of departments and representatives of the firm, Mr. L. Thurner being in the chair. The toast of "the guest of the evening" was proposed in appropriate terms by Mr. A. R. McClelland, and in reply, Mr. Max Falk gave a brief sketch of his trip, and a description of conditions in Australia and New Zealand. Amongst other toasts was that of "Our Colonial Branches," proposed by Mr. Max Falk, with which was coupled the name of Mr. H. S. Potter, the company's South African representative, who is at present on a visit to this country.

The Rt. Hon. Lord DERBY, K.G., has accepted the presidency of the B.E.A.M.A., in succession to the Rt. Hon. Lord Ampthill, who has been elected first past-president.

Mr. J. CULKIN has resigned his position as a director of Messrs. Culkin & Parkinson, Ltd., 111, Woodhouse Lane, Leeds, and is now not connected with the firm.

Obituary.—The death has taken place, after an operation, of MR. GEORGE W. MAISEY, who had for 23 years been electrician to the Aldernaston estate, near Reading.

Mr. C. G. ROBERTSON.—We regret to record that Mr. C. G. Robertson, O.B.E., submarine works manager, at Vicker's naval construction works, Barrow, died from pneumonia on Monday night. He had a great deal to do with the development of the internal combustion engine.

Mr. J. F. CLUNAS.—The death occurred at Leigh-on-Sea, Essex, on April 22nd, of Mr. James F. Clunas, who for the last four years had been attached to the staff of Messrs. Vickers, Ltd., in their electrical and latterly in the hydro-electric department. During the war, Mr. Clunas served in the Royal Naval Volunteers Signal Division, having gone through the Gallipoli campaign from the second day until the withdrawal, and afterwards served a year and a half in Flanders, when he was invalided out of the army, owing to an accident, which made him unfit for further military service. Mr. Clunas was trained and started his engineering career in the works of Messrs. Bruce Peebles & Co., at Bonnington, Edinburgh, and subsequently served in the London office of that firm. Previous to the outbreak of war, he had been a number of years in the office of Messrs. Tozer, Kemsley & Millbourn, whose service he left in order to volunteer for the army, shortly after the outbreak of war. Mr. Clunas's cheerful, straightforward, and conscientious disposition had gained him a wide circle of friends, who will be grieved to hear of his sudden death before reaching middle age, and in the midst of a promising career.

Will.—The estate of the late MR. JOHN SUMMERSCALES, of Scarborough, formerly of Armley, Leeds, who was closely associated with the Morley Electrical Engineering Co., has been valued at £42,195 gross and £40,773 net personalty.

NEW COMPANIES REGISTERED.

Sturge & Baker, Ltd. (181,382).—Private company. Registered April 27th. Capital, £8,000 in £1 shares (1,500 6 per cent. cumulative preference and 6,500 ordinary). To take over the business of electrical accessories manufacturers carried on by W. H. Sturge and E. T. Baker at Premier Works, Sheepcote Street, Birmingham, as "Sturge and Baker." The permanent directors are: W. H. Sturge, 35, Carpenter Road, Edgbaston, Birmingham; E. T. Baker, 124, Gough Road, Edgbaston, Birmingham. Secretary: E. T. Baker. Registered office: Premier Works, Sheepcote Street, Birmingham.

Invincible Electrical Engineering Co., Ltd. (181,286).—Private company. Registered April 24th. Capital, £1,000 in £1 shares. To carry on business as indicated by the title. The first directors are: J. H. Challinor, 134, Park Lane East, Tipton; B. A. Kelsall, 14, Dudley Road, Tipton; C. J. Arnold, 60, Dudley Street, Wednesbury. Registered office: 134, Park Lane East, Tipton, Staffs.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Llangefni Electric Light & Power Co., Ltd.—Transfer of mortgage dated April 7th, 1922, to secure £7,000, charged on power station and electric light works in Mill Street, Llangefni, Anglesey. Holders: National Provincial and Union Bank of England.

Connolly's (Blackley), Ltd.—Debenture dated April 12th, 1922, to secure £5,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: L.C.W. and Parr's Bank.

Tees Power Station Co., Ltd.—Satisfaction to the extent of £6,000 on February 14th and £14,900 on February 15th, 1922, of debenture covered by trust deed dated May 7th, 1918, securing £600,000.

Watson Marsh & Co. (Hampstead), Ltd.—Mortgage on 24, Golders Green Road, N.W., dated April 3rd, 1922, to secure all moneys due or to become due from the company to Barclay's Bank.

Electrical Engineering (West Bromwich), Ltd.—Mortgage dated April 7th, 1922, to secure £1,100, charged on 402, High Street, West Bromwich. Holders: T. A. Nightingale, West Bromwich, and L. J. Nurse, Tipton.

Sutton-in-Ashfield Motor and Electrical Engineering Co., Ltd.—J. Keetley, 1, King John's Chambers, Bridlesmith Gate, Nottingham, ceased to act as receiver on April 20th, 1922.

CITY NOTES.

Indo-European Telegraph Co., Ltd.

Mr. J. HERBERT TRITTON presided at the annual general meeting on April 26th. Dealing with the accounts, he drew attention to an item of £43,926, which was expenditure incurred in preparation for the re-establishment of the line. They were still without the necessary information from other administrations to enable them to close the books, but the company was not the only one in this position. The investments showed continued appreciation, while the position as regarded the Russian assets was more favourable, and writing-off was not to be undertaken at the moment. Owing to the exhaustion of the fund for equalisation of dividends, the total dividend for 1921 was restricted to 7 per cent. The chairman was pleased to inform the meeting that the Polish concession had been signed some time ago, and within the last few days the Russian Department of Posts and Telegraphs had advised them that the concession from the Moscow Government was signed on April 12th. This concession covered the whole of the territory traversed by the company's line from the Polish frontier to Persia. The company's Russian representative, Mr. Watt, was to be given credit for much in this connection. They had already secured a concession from Persia, and that being obtained from Germany had been agreed to in principle, although not actually signed. The condition of the company's line was more satisfactory than could have been expected. The line was workable for a length of over 200 miles north-west of Odessa, and similarly for 300 miles east of Odessa into the Crimea. Beyond the Straits of Kertch the line was in working order between Ekaterinodar and Tiflis, but between Tiflis and Erivan there was a short stretch where repairs were not yet completed. The section Erivan-Djoulfa on the Russo-Persian frontier, and the Persian section Djoulfa to Teheran were also in working order. The Black Sea cable from Odessa to Constantinople had already been officially opened by the Soviet Government. This cable would therefore shortly be again available for the classes of traffic previously dealt with, and should help to re-establish business relations with South Russia and the Black Sea ports. The Persian lines were in good order and available at any moment. The most arduous part of the work of reconstruction was undoubtedly the section from the German and Polish frontier in the west to the Polish-Russian frontier in the east. A new line 400 miles long had to be built, and the work would take some months. Every possible effort was being made to expedite this construction, and special appliances and material had been supplied for the purpose. It was of the utmost importance that the Indo route should again carry international traffic; accordingly, the directors were arranging, where the company's line could not at once be made available, to obtain permission from the Governments concerned to use, temporarily, a wire or wires to enable them to carry through traffic. This should offer no difficulty, and the directors anticipated an early resumption of activities in this direction.

Sir W. R. BROOKE, K.C.I.E., seconded the motion for the adoption of the report and accounts, which was carried unanimously.

The National Electric Construction Co., Ltd.

At the annual meeting, held on April 27th at the offices, 62 and 63, Queen Street, E.C., Mr. G. H. Nisbett, who presided, said that the year's working had again shown an improvement on the previous year. They had thought it advisable to take that opportunity of providing some substantial allowances. Of the sum of £4,511, at which the free-wired installations appeared in the books, it was proposed to write off £1,000. It was proposed to start a general reserve fund with

£3,000, and to provide a similar sum for a reserve for equalisation of dividends, with a view to providing as far as possible for the payment of a steady dividend in spite of the fluctuations that were inevitable with a trading company. The management expenses, &c., amounted to £4,306 as compared with £3,828 last year, owing to the larger volume of business done. The revenue from free-wired installations was practically the same as the year before. Profits on contracts showed a very satisfactory increase, being £10,946, as compared with £6,451. Interests on investments were nearly £500 down, mostly owing to the coal strike and to the subsequent trade depression. They were hoping for better results this year, and that working costs would fall to meet the altered circumstances. The profit on the working of tramway and lighting undertakings was £1,573, as compared with £2,033 in the year before. The overdraft at the bank was £7,997, as compared with £13,003 the year before, and he was glad to say that that item had since been considerably reduced—in fact, that day they had a balance to their credit of over £4,000. On the other side of the balance sheet, free-wired installations showed a decrease in value of about £290. Contracts in course of completion (less payments on account) were now only £1,736, as compared with £12,106 last year, showing a considerable reduction in that item of the company's business. They had reason to think, however, that some further business of value would shortly be in hand by the company. The expenditure of the Wisbech Electric Light & Power Co. still continued. That concern was doing very well, and it followed that with a light and power company the better its business the more the capital expenditure increased for the provision of additional plant, mains, and services. The debtors on sundry accounts were £36,724, as compared with £30,148 in the previous year, the difference being an indication of the increased business that had been done. During the year Mr. Harold T. Barnett joined the board; he had had a wide and varied experience of company work, and particularly of electrical undertakings, and they thought his assistance would be valuable to them and remunerative to the company. Generally speaking, they had every reason to be satisfied with the progress of the undertakings. Mr. W. B. Cownie, managing director, seconded the motion, and the report was adopted.

British Electric Transformer Co., Ltd. The annual meeting was held on Tuesday at Winchester House, E.C., Mr. A. F. Berry in the chair. Proposing the adoption of the report, and dealing first with the balance sheet, the chairman said that on the debtor side sundry creditors were £87,000 less than a year ago, principally due to the fact that they had been using up stocks of materials as far as possible; and also due to the falling off of orders during the latter period of the year under review. The decrease of £165,000 in the stock and the increase of nearly £100,000 in their cash position were, to a large extent, also due to the same causes. The valuation of stock and materials had been carried out by the manager on the same conservative basis as in past years, and the work in progress was taken from their cost books. As to depreciation reserve, he pointed out last year that during 1920 they had considerably added to the assets against which that reserve stood, and that although at that time they did not need to add anything to that account, it might be necessary to increase the reserve this year. It was therefore proposed to increase the amount carried to depreciation from £3,000 to £4,000, and the total would then stand at £27,300. That was against the item in the balance sheet of £284,727 for freehold land, buildings, plant, machinery, &c. With regard to the reserve account, they proposed to add £15,000 this year, bringing the account up to a little over £63,000. Turning to the other side of the account, the item of freehold land, buildings, plant, &c., had been increased by just over £47,000, the bulk of which represented new plant and machinery, spent during the past year in connection with the recent extensions of their works. Sundry debtors were down by nearly £9,000 as compared with last year. All the debts were considered good, and since the end of the year £76,348 had been received out of the £124,172 appearing in the accounts. Turning to the profit and loss account, general charges were about £10,500 more than for the previous twelve months. The gross profit on trading was nearly £40,000 more, and net profit was increased by just over £21,000. It would be seen from the report that they had an available balance of £97,594 10s. 4d. £19,000 of that was appropriated to reserve, and £21,000 to the payment of the preference dividend. With regard to the dividend on the ordinary shares, this was the fourth year in succession they had been able to recommend a dividend of 10 per cent. plus 2½ per cent. bonus. The extra remuneration to the directors, amounting to £4,261, was calculated in accordance with the Articles of Association, and the increase of about £2,000 in that item was due to the increased profit earned. It would be seen that they were proposing to distribute about two-thirds only of the available profits and to carry forward a balance to next year of £12,708. In no previous year had they shown as good results as those for 1921, and sometimes he feared that the shareholders were so used to prosperity that a feeling might be engendered causing them to forget that the company had been through times of adversity. They had been, and were going through, times of such difficulty of late that he could not help feeling the time might not be distant when the strong confidence of the shareholders would again be needed to help them tide over one or more years during which it might not be possible to produce those splendid results to which they had now become accustomed, and which therefore, to some extent, they expected. It would have been pleasant for him to have referred only to those things that pleased, but at those meetings they had always endeavoured to give the shareholders such information as they could, and where it had been in any way possible to forecast results they had endeavoured to do so. They might remember that last year they started with 50 per cent. more work in hand in money value, or 30 per cent. more in horse-power, than at the beginning of 1920. This year they started with, roughly, 60 per cent. less work in hand, calculated in horse-power, which would be still worse in money value, than they had at the beginning of 1921. Further, the work in hand would not carry with it the same ratio of profit which they looked forward to last year. The difficulties due to that shortage of work, magnified, as they were, by strikes and lock-out troubles, could not be overlooked. Last year he gave the opinion that the next few years would test the capacity of captains of industry. Some of them hoped that adversity would bring the different interests in the ranks of industry much closer together, but they all knew that that was a state of affairs to be wished and worked for rather than one accomplished. It appeared to him that the more active minorities whose business or avowed intention it was to work trouble between the different members of the various British industrial teams were having their own way far too much, and he feared that industry would not prosper as they desired until its natural leaders were actually encouraged to lead. They were, however, well aware that the Stock Exchange fraternity were indicating in no uncertain way their belief in a return to comparatively good times. There were signs of some improvement in the heavier industries, but he would be agreeably surprised if the return to prosperity was sufficient to enable ordinary dividends of any appreciable value to be continued, at any rate, for the next year. Those extremely bad times could be made to have their uses, and in a company such as theirs there was very much to do in the way of staff work and co-ordination of effort in connection with other sections of the industry. The results of the past year were the results of a carefully thought-out policy loyally carried out by their office and works staff. Unless their plans had been laid long ago with the greatest prudence they might even during the past year have found themselves with a heavy loss instead of record profits. Mr. T. Rowe seconded the motion, which was unanimously agreed to after a short discussion of a congratulatory character.

Radio Corporation of America. The accounts for 1921 show gross income from Transoceanic communications $2,138,626; gross sales, $1,468,920; from marine service, $553,298; total, $4,160,844. Deducting general operating and administration expenses, depreciation of plant and cost of sales, $3,762,231, the balance was $398,613, making with other income, $426,800, applied against amortisation of patents. The capital consists of 3,955,974 shares of 7 per cent. preferred stock of par value of $5 per share, and 5,732,000 shares of common stock of no par value, against which there is equity of $12,039,607, or $2.11 per share for each share of common stock. No dividend was paid during the year 1921 on either the preferred or the common stock outstanding. The report states that the current liabilities have been reduced by about $930,000, and the current assets exceed current liabilities by nearly $4,000,000. During the year $3,000,000 was spent in extending plant and equipment, investments in which now total $12,702,086. Reserves for depreciation and obsolescence of plant and amortisation of patents amount to $2,318,135.—*Financial Times.*

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 148a:—

Fairbairn Lawson Combe Barbour.—131,530 new ordinary shares of £1 each, fully paid, Nos. 918,471 to 1,050,000.

Pennsylvania Water and Power Co.—$245,000 first mortgage 5 per cent. sinking fund gold bonds, 1940, Nos. 10,941 to 11,185 ($1,000).

Stewarts & Lloyds.—8,070 deferred shares of £1 each, fully paid, Nos. 2,630,031 to £2,638,100.

Application has been made to the Committee to allow the following to be quoted officially:—Mersey Power Co.—£300,000 7¼ per cent. mortgage debenture stock.

Direct United States Cable Co., Ltd.—The total income during the year ended March, 1922, was £45,224 plus £4,265 brought forward. After providing for income tax, directors' fees, and administration expenses, and paying a dividend of 4 per cent. for the year, £3,916 remains to be carried forward. Practically the whole of the investments have been retained, and these have appreciated in value considerably during the year.

City of Buenos Aires Tramway Co. (1904), Ltd.—Dividend of 1s. 3d. per share (being at the rate of 5 per cent. per annum), less tax, for the quarter ended March 31st.

Southern Brazil Electric Co., Ltd.—Meetings of the 6 per cent. mortgage debenture holders, 8 per cent. ten-year-note-holders and shareholders of this company were held last week, in London, at Winchester House, E.C., to consider a scheme of arrangement.

Mr. E. H. Tootal, the Chairman, in moving the resolution at the meeting of the noteholders, said that at the rate of exchange now ruling they were only earning enough to meet the interest on the issue of 6 per cent. debentures, and there was nothing over to continue their redemption. The currency revenue was increasing satisfactorily, and the prospects of a profitable expansion of the business were good. It only required a rise in the value of the milreis to improve their position, and, according to the general opinion of those conversant with Brazilian affairs, a rise could be confidently expected in the future. The motion was carried unanimously.

The scheme was subsequently approved by the shareholders. The meeting of the 6 per cent. mortgage debenture holders was adjourned for 14 days as a quorum was not present.

Madras Electric Tramways (1904), Ltd.—The gross profit for 1921 is £34,661. After debiting interest and London office expenses, making provision for the debenture stock sinking fund, and transferring £10,000 to depreciation and renewal account, there remains £9,744, plus £5,556 brought forward. The preference dividend for the year, less income tax, absorbs £6,000, 5 per cent. free of tax is to be paid on the ordinary shares, and £6,436 is to be carried forward. The traffic receipts and running expenses in rupees show decreases of 15.5 per cent. and 10.5 per cent. respectively on 1920. The results for the past year were prejudicially affected by a strike which continued from January 10th to February 26th, and by the general depression which prevailed in India. During the strike a service of motor-'buses was inaugurated and is still competing with the tramway.

North of Scotland Electric Light and Power Co., Ltd.—The report for 1921, to which we made brief reference in our issue of April 21st, shows that the connections in Montrose have increased from 1,743 kW to 1,849 kW, in Brechin from 928 kW to 934 kW, and in Inverness from 2,346 kW to 2,513 kW, making a total of 5,296 kW connected in the three towns. The capital has been increased by the issue of 25,000 £1 cumulative 10 per cent. preference shares, which have all been subscribed for. The issue has enabled the directors to reduce the amount outstanding on loan account by £25,000. After providing for interest on debentures and loans, amounting to £2,724, and making provision for income tax, amounting to £927, there remains £7,777, plus £634 brought forward. At the meeting held on April 26th it was resolved to pay a 10 per cent. dividend on preference shares, and a 1¼ per cent. dividend (being the maximum dividend allowed under the Temporary Increase of Charges Act) on the ordinary shares. £4,500 is placed to renewal reserve account, and £786 carried forward.

Arbroath Electric Light and Power Co., Ltd.—In the report for 1921, which was adopted at the annual meeting held last Friday, the directors stated that they proposed shortly to offer to the public part of the new shares created in 1920 in order to provide for an extension of plant. A dividend of 8 per cent., less tax, on ordinary shares for the year, and an additional dividend of 1 per cent., less tax, on preference shares, making 6 per cent. for the year, were declared. The report showed profits amounting to £3,935, plus £1,080 brought in, less interest charges, and 5 per cent. preference dividend paid (£991). £1,000 is placed to reserve and renewals fund (making it £11,000), and, after payment of ordinary and additional preference dividends, £1,679 remains to be carried forward. The business is developing healthily. The number of consumers has largely increased, and large sums have been spent on new mains.

The A.E.G. in Danzig.—The A.E.G. Electricity Co. of Danzig, which has a share capital of 300,000 marks, reports net profits of 72,970 marks for 1921, as compared with 92,081 marks in 1920. The dividend is at the rate of 20 per cent., as in 1920. The outstanding debts amounted to 10,370,000 marks at the end of the year (15,140,000 marks in 1920), while the creditor account reached 8,870,000 marks (28,840,000 marks).

Gateshead and District Tramways Co.—Total revenue for 1921, £141,803. After deducting all expenses, including £3,000 provision for renewals, the balance is £43,818, plus £2,018 brought forward. There is put to sinking fund for redemption of mortgages £3,173; 6 per cent. is paid on the 6 per cent. preference shares and 5 per cent. on the 5 per cent. preference, also 10 per cent. on the ordinary, leaving £22,407 to carry forward. Capital expended during the year, £49,416.

Dawlish Electric Light Co.—At the annual meeting on April 7th, Mr. F. G. Avant, the chairman, announced a balance of £824 on the year's working. The directors advised the distribution of a dividend of 5 per cent. The Chairman said that only £7,000 of the £10,000 capital had been taken up; the balance was needed to improve the company's position.

Mexborough and Swinton Tramways Co., Ltd.—The directors announce a dividend of 2½ per cent., free of tax. £2,000 is put to reserve and renewals account; £245 is written off furniture, fittings, plant, &c.; £500 is put aside for income tax; and £246 carried forward.

Craigpark Electric Cable Co., Ltd.—For the year ended March, 1922, there was a net profit of £12,054 (after providing for Corporation Tax), plus £2,160 brought forward. It is proposed to put £2,000 to depreciation of buildings and machinery, and £2,000 to reserve; the preference dividend of 6 per cent. for the year requires £2,850; a dividend of 12½ per cent. is to be paid on the ordinary shares (£4,687), leaving £2,676 (subject to directors' fees) to carry forward. The coal strike compelled the company to shut down for six weeks, and trade depression which followed resulted in short time having to be worked for months thereafter. Meeting, Glasgow, May 5th.

Great Northern Telegraph Co., Ltd., of Denmark.—For the year 1921 the directors recommend the distribution of a total dividend and bonus of 22 per cent., including the 5 per cent. already paid, transferring £33,333 to the reserve and renewal fund; £55,556 has been allotted to the pension fund. It is further proposed to set aside £222,222 for extraordinary taxes, and to carry forward £302,679 to 1922. The general meeting will be held at Copenhagen on June 30th.

Calcutta Electric Supply Corporation, Ltd.—The net revenue for 1921 was £216,977, against £213,334 for 1920. The total dividend on the ordinary shares is 10 per cent., with a bonus of 1 per cent.

English Electric Co., Ltd.—A dividend of 5 per cent., less tax, on the ordinary shares for 1921 is recommended.

Hart Accumulator Co., Ltd.—Dividend 11 per cent., subject to tax, on the ordinary shares.

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange is used to taking its Budgets and its pleasures with equal philosophy. Consensus of House opinion declared that Sir Robert Horne's concessions were no more, though considerably less, than might have been expected. They are read by the investment markets much in the same way as anything else is which assists in the direction of lower taxation. They are obvious links in the chain of the Government's determination to reduce money rates in order to cheapen the costs of living, and, if possible, to stimulate trade.

Upon the securities, the dividend on which is paid free-of-tax, the income tax proposals had little, if any, direct influence. Certainly the cable group is no weaker, although some of the stockholders in the Eastern circle of companies were rendered a little uneasy in advance of the announcement. To work out the actual difference, a yield of 5 per cent. on the money with tax at 6s. in the pound is equivalent to £7 2s. 6d. gross, while with a 5s. tax, the return is equal to £6 13s. 4d. per cent. The latter, which can be obtained from the Eastern stocks—Globes, Western, Eastern Extension and Eastern—is high enough to attract investment money at a time when banks pay only 2 per cent. on deposit.

The spectacular market amongst electrical issues is that for the various Marconi shares. Radio ordinary, the old American Marconis, suddenly jumped from 16s. to 26s.; the preferred moved more quietly, from 14s. to 16s. 6d. Both reacted from the best. American buyers have been in the field, on the idea that the recent wireless conference in the States has eliminated competition, and opened the way to vigorous new developments. Marconi, parent, shares went over 50s. before giving way to 2 7/16 as the inevitable profit-takers came into the market. Canadian Marconis went up to 12s., and held most of their advance. The rise in Radios does not let out at a profit most of the British holders of American Marconis, but the market has been so dead, for a couple of years past, that the present flutter of excitement is extremely welcome.

Last week's remarkable series of rises in Mexican and other foreign utility-traction descriptions has been well maintained. It dislodged but little stock, holders of Mexicans preferring to await the next turn in the financial wheel revolving at Washington. Mexican Light & Power issues are higher. Visitors from Vancouver, staying in London on semi-official business, have spoken cheerfully on the subject of the British Columbia Electric Railway, and the demand for the stocks is not surprising. Anglo-Argentine Tramways first preference are being exchanged by some people for the same company's Seconds, upon which there are heavier arrears of back dividends to come. Canadian Electric bonds are better, would-be buyers insisting that prices should be marked-up when bids fail to produce any supply of stock.

In the electric supply shares, City Lights are better at 38s. 9d., St. James's rose to 8¼, and Westminsters to 7¼. Metropolitan preference are harder at 3¾, but the County of London ordinary at 25s. are a trifle easier. The manufacturing group shows a good deal of strength, the feature being a rise of 7s. in Crompton ordinary, which has taken the price to 22s. Edison debenture at 63 is a point to the good, and Electric Constructions hardened to 25s. Last week's rise of 6s. in English Electrics has served to bring in a few sellers, and the price has gone back to 13s. 9d. General Electric ordinary are lower at 23s. 3d., but the preference at 22s. 3d.

are decidedly better. India Rubber shares advanced to 15s., and British Aluminiums hold their rise of the previous week.

The railway market is generally better. Underground Income bonds advanced to 78½; Metropolitans and Districts are both 10s. higher. Underground £10 shares at 2½ are ¼ up, though the "A" shares at 6s. 6d. have given way a trifle. The speculation which sprang up a few weeks ago in the Contingent Certificates of the company has died down, and the price of these is now about sixpence. London Electric Railway shares are better at 4. East Londons have gone back a trifle, owing to a diminution of interest in the stocks.

Dealings are expected to begin in River Plate Electricity new shares during the course of this week, and the market will probably open on the basis of 20s. to 22s. Other new issues are maintaining their prices, and the holders decline to sell their stock (except in those cases where there are stale stags about), owing to the difficulty of replacing good investments with others at prices that yield respectable rates. Whitehall Electric debenture is now fully-paid, and stands at 87½—a discount of ¼ per cent.; the preference shares at 18s. 6d. are 1s. 6d. discount.

There is nothing much doing in the Rubber market, although trade in the produce is said to be reviving with Germany. The armament shares are better, an abrupt rise in Vickers drawing attention to the group as a whole. The iron and steel market remains dullish, under the influence of the engineering lock-out. This, together with the situation which has developed at Genoa and various other disturbing factors abroad, are neutralising in the Stock Exchange markets any favourable effect which might otherwise have been produced by reduced taxation announced in the Budget.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1920.	Dividend. 1921.	Price May 2, 1922.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	12	12	7½	—	£8 0 0
Charing Cross Ordinary	8	9	6½	—	7 4 0
do. do. do. 4½ Pref.	4½	4½	8¼	—	6 4 2
Chelsea	6	6	5½	—	5 9 1
City of London	14	14	1⅛	+ 1/16	7 4 6
do. do. 6 per cent. Pref.	6	6	21/-	—	5 14 2
County of London	8	8	1½	— 1/16	6 8 0
do. do. 6 per cent. Pref.	6	6	1	—	6 0 0
Kensington Ordinary	9	10	6¾	—	7 11 0
London Electric	2½	4	1½	—	7 2 8
do. do. 6 per cent. Pref.	6	6	4⅛	—	6 9 9
Metropolitan	7	7	5½	—	6 16 7
do. 4½ per cent. Pref.	4½	4½	8¼	+ ¼	6 0 0
St. James' and Pall Mall	12	12	8¼	+ ¼	7 7 8
South London	7	7	8⅜	—	8 7 0
South Metropolitan Pref.	7	7	1½	—	6 4 8
Westminster Ordinary	10	10	7½	+ ¼	7 0 4
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	103	+1	5 16 6
do. Def.	1½	34/3	23	+ ½	7 11 6
Chile Telephone	6	6	6½	+ ½	4 16 6
Cuba Sub. Ord.	7	7	8½	— ½	8 4 8
Eastern Extension	10	10	19½	+ ¼	5 8 3
Eastern Tel. Ord.	10	10	194½	— 1	5 2 10
Globe Tel. and T. Ord.	10	10	19½	—	5 8 3
do. do. Pref.	6	6	11½	—	5 7 7
Great Northern Tel.	22	24	31	— ½	7 14 0
Indo-European	10	10	40½	+2½	6 3 5
Marconi	25	15	2⅞	+ 1/16	6 3 0
Oriental Telephone Ord.	12	12	2¼	—	*5 12 0
United R. Plate Tel.	8	8	7½	+ ½	*5 8 6
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	19½	—	*5 3 3
HOME RAILS.					
Central London Ord. Assented	4	4	66	—	6 1 3
Metropolitan	1½	2½	41½	+ ½	5 8 5
do. District	Nil	1	9¼	+ ¼	2 18 0
Underground Electric Ordinary	Nil	Nil	2½	+ ¼	Nil
do. do. "A"	Nil	Nil	6/6	— 6d.	Nil
do. do. Income	2	4	78½	+1	*5 2 0
FOREIGN TRAMS, &c.					
Anglo-Arg. Trams. First Pref.	5½	12½	83	—	7 11 9
do. do. 2nd Pref.	Nil	5½	4	—	6 17 6
do. do. 5 per cent. Deb.	5	5	84½	+1	5 18 4
Brazil Tractions	Nil	Nil	49	—1½	Nil
British Columbia Elec. Rly. Pfce.	5	5	77½	—	6 9 0
do. do. Preferred	5	98/-	73½	—	*6 5 10
do. do. Deferred	9	134/-	75½	—1	*8 4 2
do. do. Deb.	4½	4½	73	+1	5 16 5
Mexico Trams. 5 per cent. Bonds	Nil	Nil	70½	—	—
do. do. 6 per cent. Bonds	Nil	Nil	86½	+1	Nil
Mexican Light Common	Nil	Nil	28½	+2	Nil
do. Pref.	Nil	Nil	54	+3½	Nil
do. 1st Bonds	Nil	5	74½	—	6 14 3
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	8	—	5 6 8
British Aluminium Ord.	10	10	4½	—	—
British Insulated Ord.	15	15	1⅛	— 1/16	7 14 10
Callenders	15	15	2	—	7 10 0
,, 6½ Pref.	6½	6½	1¼	—	5 15 7
Crompton Ord.	10	10	22/-	+7/-	9 1 10
Edison-Swan	10	—	5/-	—	—
do. do. 5 per cent. Deb.	5	5	63	+1	7 18 9
Electric Construction	10	10	1½	+1/8	8 0 0
English Electric	8	8	18 9	— ¼	11 12 10
do. Pref.	6	6	7	—	8 17 2
Gen. Elec. Pref.	6½	6½	22/6	+1/6	5 16 10
do. Ord.	10	10	33/6	—1/-	8 12 0
Henley	15	15	2½	—	7 1 2
do. 4½ Pref.	4½	4½	4½	—	5 6 0
India-Rubber	10	—	3	+ 1/16	—
Met.-Vickers Pref.	8	8	2⅜	—	6 14 9
Siemens Ord.	10	10	37/6	—	*7 5 5
Telegraph Co	20	20	26½	+ ¼	*4 14 6

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, May 3rd.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic per lb.	8½d.	..
a Ammoniac Sal per ton	£66	..
a Ammonia, Muriate (large crystal) ,,	£58	..
a Bisulphide of Carbon ,,	..	..
c Borax ,,	£30	..
a Copper Sulphate ,,	£27	..
a Potash, Chlorate per lb.	5d. to 5½d.	..
a ,, Perchlorate ,,	7½d.	..
a Shellac per cwt.	£12 5s.	..
a Sulphur, Sublimed Flowers ,,	£13	..
a ,, Lump ,,	£11	..
a Soda, Chlorate per lb.	3½d.	..
a ,, Crystals per ton	£7	..
a Sodium Bichromate, casks per lb.	5½d.	..
METALS, &c.		
b Aluminium, Ingots per ton	£190	..
b ,, Wire per lb.	1/9 to 2/6	..
b ,, Sheet ,,	1/6 to 2/-	..
p Babbitt's Metal and Anti-friction Metal—		
Grade I per ton net	£147	..
Grade II ,, ,,	£106	..
Grade III ,, ,,	£62	..
c Brass (rolled metal 2" to 12" basis) per lb.	8¾d.	½d. dec.
c ,, Tubes (solid drawn) ,,	11½d. to 11¾d.	..
c ,, Wire, basis ,,	9¾d.	½d. dec.
c Copper Tubes (solid drawn) ,,	1/1½	..
c ,, Bars (best selected) per ton	£88	..
c ,, Sheet ,,	£88	..
c ,, Rod ,,	£88	..
d ,, (Electrolytic) Bars ,,	£66 10s.	..
d ,, ,, Sheets ,,	£145 10s.	..
d ,, ,, Wire Rods ,,	£76 10s.	..
d ,, ,, H.C. Wire per lb.	9½d.	..
f Ebonite Rod ,,	3/6	..
f ,, Sheet ,,	3/-	..
n German Silver Wire ,,	2/6	..
h Gutta-percha, fine ,,	12/6	..
h India-rubber, Para fine ,,	10½d.	½d. inc.
f Iron Pig (Cleveland Warrants) per ton	Nom.	..
f ,, Wire, galv. No. 8, P.O. qual. ,,	£27	..
g Lead, English Pig ,,	£25	£1 inc.
g Mercury per bot.	£10 15s. to £11	..
e Mica (in original cases) small per lb.	3d. to 8/-	..
e ,, ,, ,, medium ,,	4/- to 8/-	..
e ,, ,, ,, large ,,	10/- to 20/- & up	..
p Phosphor Bronze, plain castings ,,	1/1	..
p ,, ,, drawn bars and rods ,,	1/3½	..
p ,, ,, rolled strip & sheet ,,	1/3½	..
p ,, ,, Wire ,,	1/3	..
o Platinum per oz.	£19 10s.	..
d Silicium Bronze Wire per lb.	1/1½	..
r Steel, Magnet, in bars ,,	1/-	..
n Tin, Block (English) per ton	£150 to £151	30s. to 50s. dec.
n ,, Wire, Nos. 1 to 16 per lb.	2/-	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
j Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

The British Association.—*The Times* states that Sir Charles Parsons has conveyed to the Trustees of the British Association a gift of £10,000, which is placed unreservedly at the disposal of the Council.

The Association applies its funds most efficiently, but is never well-provided in this respect; consequently this generous gift will be heartily welcome, and will relieve the Trustees of the burden of anxiety under which they have been labouring lest the activities of the Association would have to be curtailed. Since its foundation in 1831, the British Association has made grants in aid of research exceeding £83,000.

This is the largest donation the Association has received for many years.

Factory Magazines.—More than 60 editors of works magazines or "factory newspapers" attended the Conference of Works Editors at the offices of the Industrial Welfare Society on April 28th. This was the second conference of the kind organised by this society, and the enthusiasm of the delegates augurs well for the future of the movement to establish these publications in all the large factories and workshops in this country. It is very clear that magazines of this kind, if well edited and organised, will prove a valuable stabilising influence in industry. They form a common platform, where all sides can voice their views; they help each side to appreciate the difficulties of the others; they arouse interest in the most mechanical operations; they develop that spirit of good-will which is essential to the real efficiency of industry.

THE ELECTRO-METALS STEEL FURNACE.

In common with all other practical applications of electricity, the electric furnace has been developed to a remarkable degree during the past ten years. The possibilities of the electric furnace were first seriously considered by Sweden, a country which, while possessing large iron-ore deposits, had insufficient coal for their treatment, but which was endowed with a means of generating electricity cheaply—its extensive water-power. One of the first Swedish furnaces, the "Jern-Kontoret," was described in the Electrical Review of July 12th, 1912, and we give below some details of a modern furnace made by Electro-Metals, Ltd., which em-

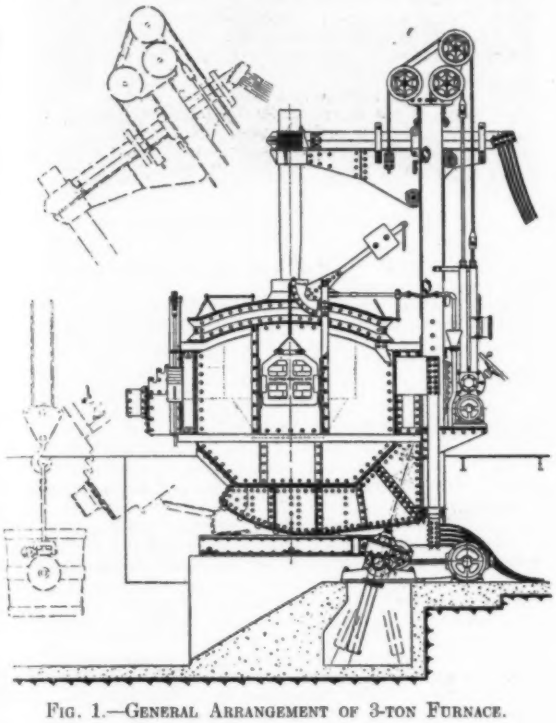


Fig. 1.—General Arrangement of 3-ton Furnace.

bodies most of the principles of the Swedish prototype, but including developments which have taken place mainly in Great Britain.

This furnace is of the conducting hearth type, and operates on two-phase, low-pressure alternating current, obtained either from a transformed h.p. two-phase supply, or, by way of Scott-connected transformers, from a three-phase supply. The magnetic field set up by the combination of the two arcs, provided between carbon electrodes and the hearth, imparts a circulation to the charge ensuring uniform heating, which is of special advantage in the melting of special alloy steels, owing to the different densities of the materials employed. To make the system a success it is important that not only should the furnace itself be correctly proportioned and strongly constructed, but also that the best possible control of electrodes and tilting methods should be provided.

The hearth of the Electro-Metals furnace is elliptical in plan, the axes of the ellipse at the surface of the bath being so proportioned that the radiation from the two arcs gives equal temperatures all round the periphery, resulting in even melting. The furnace bodies are of heavy steel plate with longitudinal and transverse bracing, and the refractories are designed with a view to both strength and small radiation losses. As the regulation of the load is effected by the raising or lowering of the electrodes, the control gear has to be designed to ensure accuracy and ease of adjustment. The weight of the electrode, with its contact clamp, copper leads, and supporting carriage, is considerable; accordingly, in order to minimise the power required for hoisting, a counterweight is introduced which travels in the opposite direction to the electrode. This counterweight is adjustable so that the weights of varying lengths of electrode are compensated, and the total counterweight is so arranged as to require slightly less power to raise than to lower the electrode. This ensures rapid reduction of overload and gradual motion when moving the electrode down to make contact with the charge. In furnaces of less than three tons capacity the electrode operation is done by hand; in the larger sizes motors, operated by automatic control gear, are employed. In the latter case auxiliary hand control is also provided in case of the failure of the motors for any reason. Two ammeters are mounted at the back of every furnace to enable an operator to regulate the hand controls. Every electrode carriage is suspended from two steel ropes, so that in the event of a rope breaking the electrode is not dropped into the charge. The half-ton and one-ton furnaces are tilted by hand. Bevel and worm gears, operated by a large hand-wheel, actuate a pinion which engages with a gear segment at the opposite side of the furnace, giving a forward tilt of 30 deg., and a backward tilt of 5 deg., from the vertical. These small furnaces rest on ball-bearing rollers, and as the load is balanced a very small effort is required to tilt them. The larger sizes have motor-driven tilting gears, situated behind and below the furnace. The motor is operated by means of a tramway-type reversing controller arranged for dynamic braking when the motor supply is d.c.; a.c. motors are fitted with solenoid-operated brakes. An enclosed chain drive transmits the power to the tilting gear, which is mounted on trunnions to enable it to follow the angle of tilt, this sleeve being cut as an internal worm. By its rotation the long duplex helical rack is moved outwards or inwards. This rack, being connected to the furnace body by a special swivelling cross-head, pushes the furnace over, or draws it back to its normal position. Fig. 1 is a side elevation of a 3-ton furnace, showing the electrode and tilting gears. The electrode holders are designed to obviate water cooling. The copper contact strips round the electrode are pressed against its surface by means of a chain link belt. Ample contact area is allowed and the grip is made by means of a steel screw with swivel nuts. The chain belts are fastened at the back to a bronze casting, in order to break the magnetic circuit around the electrode, the casting in turn being secured to the electrode carriage. Surrounding the electrodes at the roof openings are combined water coolers and electrode economisers, the construction of which is shown in fig. 2. The bronze water cooler rests on the brick roof, and serves to protect it at the point at which it is subjected to the greatest heat. The economiser consists of four sealing rings, each composed of three hollow cast-iron segments. These rings are so shaped that they tend to slide one over the other, making contact with the electrode and preventing smoke and flame issuing from the electrode openings. As a result the portion of the electrode above the roof is kept cool and does not burn away, and the electrode does not taper.

The external electrical equipment plays an important part in these furnaces. Furnaces of three tons capacity or over have two totally-enclosed motors for the operation of the electrodes, these motors being automatically controlled. Where direct current is not available, a small motor-generator set is necessary as up to the present no really satisfactory system of automatic control has been devised for a.c. electrode motors. The switchgear for the control of the h.p. supply to the transformers is usually enclosed in a sheet-steel cubicle, and consists of a knife-pattern isolating switch interlocked with a main oil-break switch, suitably protected by an overload relay and trip gear. Furnaces of

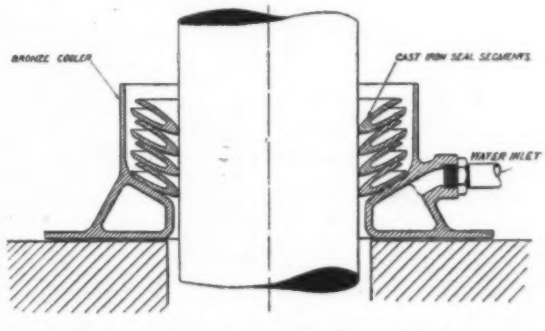


Fig. 2.—Combined Water-Cooler and Electrode Economiser.

more than 10 cwt. capacity are arranged with a choice of two or more secondary voltages and a selector switch is provided. The transformers themselves are oil-immersed; the larger sizes are water-cooled. The secondary windings are brought out in the form of heavy copper bars, interleaved to reduce induction losses.

Electro-Metals furnaces of three tons capacity and upwards are equipped with the "Watford" system of automatic control for the electrode operating motors. The control gear is mounted in totally-enclosed, cast-iron pillars, one for each electrode, with protected glass doors. The automatic control is governed by the current from the secondary winding of a series transformer mounted around the low-pressure leads to the electrode. Small variations in the current are dealt with by the current regulator which imparts a series of small impulses to the electrode motor. When a considerable variation in the load occurs, however, a superimposed voltage control is automatically brought into operation, giving a continuous motion to the electrode motor which results in a rapid

restoration to normal load. Auxiliary contacts on the regulators cause dynamic braking of the motor armature as soon as the power supply to the motor ceases. A drum-type controller for hand operation is also fitted. Limit switches are provided to prevent the over-travel of the electrodes, and a further feature provides for the automatic raising of the electrodes clear of the charge, in the event of the main oil switch being tripped on an overload, preventing the possibility of closing the main switch on a load.

The hearth current, after passing through the conductive lining, is collected by means of a mild steel casting, placed below the hearth and continued up behind the back wall of the furnace, passing out through the back plate at a point above the level of the liquid charge. Fig. 3 is a cross-section through a typical furnace, and the materials used in construction are indicated.

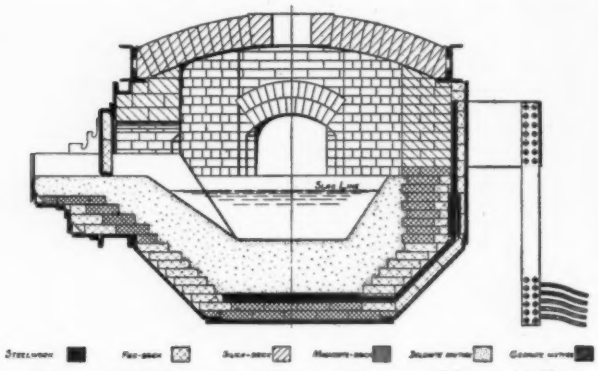


Fig. 3.—Cross-Section of Hearth, Showing Materials Used in Construction.

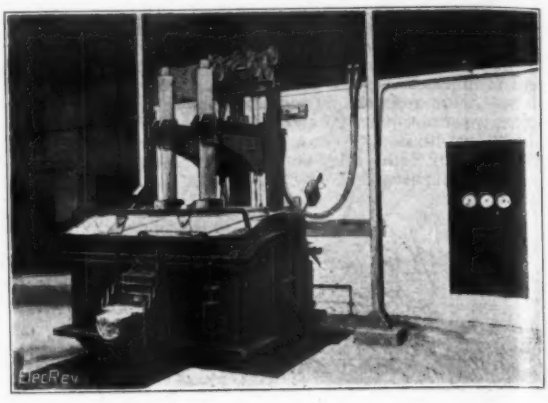


Fig. 4.—An Installed 1½-ton Furnace.

Fig. 4 is an illustration of a 1½-ton Electro-Metals furnace, installed at the works of Messrs. Sutherland, Ltd., Belfast.

THE SWISS FRANC AND GERMAN MARK.

A depressing account of Swiss economic conditions is presented in the report which has recently been issued by the Department of Overseas Trade (1s. 9d.), from the pen of H.M. Commercial Secretary, at Berne (Mr. J. Picton Bagge).

It depicts the situation up to December last and, unfortunately, little improvement has since taken place. Then every branch of industry was suffering. Over 20 per cent. of the factory hands were entirely without employment, whilst a further 13 per cent. were only partially employed. Taxation and high cost of living are credited with part responsibility. Industrialists contend that farmers are unduly favoured, while the latter plead that without tariff protection they would be lost. The Government's task of holding the balance between the two parties is made more difficult by the deficits in the Federal Budgets.

Machine Industry.

The state of the machine industry is portrayed by the state of unemployment. At the beginning of 1920 there were 53,575 workmen employed by the 178 firms forming the Union of Swiss Machine Manufacturers. On the 21st of November, 1921, 13,000 of these had been dismissed. Of the remaining 40,000, only about 18,000 are fully employed, whilst the remainder are working reduced hours to the extent of 30 to 50 per cent. In consequence of the high rate of exchange of the Swiss franc, exports are greatly reduced, whilst French locomotive orders have ceased owing to the need of keeping French works occupied. Switzerland's severest competitor, namely, Germany, is able to undersell Swiss manufacturers by 70 per cent., owing to the high-internal purchasing power of the mark. At the present moment, says the report, the German manufacturer can buy his raw material for one-third and even less of the price paid by Swiss manufacturers in the world's markets, whilst his wage bill is about one-tenth of that of the Swiss producer.

Swiss machine industries are dependent on the welfare of other countries, for the home market can only consume about 25 per cent. of the production. A stabilisation of the German rate of exchange would materially contribute to a revival.

Trade depression has had its usual effect on labour, and at the date of the report (December) there were no strikes or lock-outs.

With regard to wages, including bonus for the rise in the cost of living, they were as follows at the beginning of the year :—

	Fr. per hour.
For skilled workmen	1.90
For workmen's assistants	1.58
Average for adult workman	1.76
(1914 ... ... 65.8 centimes).	

Since then the cost of living bonus has been reduced by half, making a reduction of 8 per cent. in the wage bill, including bonus. A further reduction may be expected in the near future, by which it is hoped to bring the cost of production down to a sterling basis competition level. Competition with France will scarcely be possible until the exchange on France rises to fr. 50.

A possibility to be faced is the transfer of Swiss industries to neighbouring countries under the pressure of present conditions. Should the factories be transferred to other countries a number of the better workmen would also emigrate. So far no appreciable movement has been made in this direction, but it is impossible to foretell what the future may bring.

The balance sheets of many machine and metallurgical firms show the gravity of the present position. The fall in the cost of living, with consequent reduction in wages, may, however, enable the Swiss manufacturer to compete once more. In this he will also be favoured by the great decrease in the price of coal, of which, owing to stocks on hand, he has not yet been able to avail himself.

The following table shows the most important imports of machinery during the first nine months of the year 1921, compared to the same period of 1920 (the latest figures available) :—

Imports (in tons).

	1921 (9 *months*).	1920 (9 *months*).
Parts of machinery	2,685	4,323
Steam boilers	1,442	2,212
Spinning machines	605	849
Weaving looms	415	901
Knitting machines	189	345
Embroidery machines	5	617
Sewing machines	357	1,093
Agricultural machines	2,098	3,827
Dynamo-electric machines ...	418	292
Machine for the manufacture of paper	1,258	817
Machine tools	3,472	9,235
Machines for the preparation of food-stuffs	738	1,351

It will be seen that the only increase in machinery imports relates to dynamo-electric machines and to machinery for the manufacture of paper, the figures being respectively 418 tons (292 tons), and 1,258 tons (817 tons). No less than 329 tons of the former article was imported from Germany (252 tons in 1920), 49 tons from France (10 tons), 18 tons from Norway (nil), six tons from the United States (12 tons), and three tons from Great Britain (two tons). Germany was also the principal supplier of machinery for the paper-making industry and furnished 1,224 tons out of a total of 1,258 tons.

Electro-Technical Industry.

The electrification of the Federal Railways has given good employment to this industry, but the general difficulties of to-day have had their effect on the export trade, for which the factories mostly work. Some of the large factories export as much as 80 per cent. to 90 per cent. of their production. Foreign competition has been much felt in both the home and foreign markets, and so severe did it become as regarded accumulators, cables, incandescent lamps,

and lamp stands that the import of these articles has been restricted.

The high cost of production is another factor that militates against successful Swiss competition. The reasons given for this high cost of production, apart from high wages necessitated by the high cost of living, are the reduction of weekly hours of work to 48 and a decrease in the desire to work. It is felt that this can only be overcome by the establishment of closer and better relations between employers and employed.

Swiss manufacturers express the hope that, provided they can effect reasonable reductions in the cost of production the high quality of their goods will enable the industry to maintain its markets.

As regards exports, dynamos and electric motors occupy the principal place, and an increase is recorded as compared with 1920. The respective figures are:—1921, 5,359 tons (fr.32,467,000); 1920, 5,046 tons (fr.30,939,000). France was the chief client with 1,264 tons. Other importers were Belgium (700), Spain (618), Norway (538), Great Britain (360), Holland (327), Dutch East Indies (257), Japan (178), China (105). The loss of the Russian market is much felt in this item.

The export of electric meters was considerable and amounted to 357 tons (fr.7,433,000), Great Britain and Belgium each imported 71 tons, whilst France (63), Italy (43), and Czecho-Slovakia (33) were also buyers. Other markets were Australia, Japan, Brazil, Chile, and Holland.

The export of telephone instruments, cables, &c., was very small, for the factories work principally for the home market.

Incandescent lamps found a good market in Italy (64 tons). The total export was 106 tons, valued at 3,247,000 francs.

The construction of electric locomotives has made much progress, and very powerful machines have been built to the order of the Federal Railways. Three locomotives were exported to Peru.

Machinery Exports.

With the exception of locomotives (1,081 tons as against 695 tons), spinning machinery (1,838 as against 1,542), knitting machinery (411 tons as against 394 tons), dynamo-electric machinery (as shown above), and hydraulic machines and pumps (4,301 tons as against 2,447 tons), exports belonging to this category of goods have declined considerably. It may be of interest to note that out of the 37 locomotives exported by Switzerland, 11 were purchased by Austria, 10 by Spain, 5 were shipped to East Africa, and 9 to the Dutch Indies. Only three electric locomotives were exported (as against one in 1920), all of them being shipped to Peru.

The principal purchasers of hydraulic machines and pumps were Spain (1,097 tons—382 tons), Japan (1,065 tons—234 tons), France (707 tons—832 tons), and Great Britain (271 tons—156 tons).

Striking decreases are observed with regard to exports of machine tools (2,007 tons—6,537 tons), machine tools for the preparation of foodstuffs (2,140 tons—3,599 tons), gas and petroleum engines (3,948 tons—6,088 tons), steam boilers (1,744 tons—2,324 tons), embroidery machines (1,039 tons—3,212 tons), agricultural machines (248 tons—401 tons), and printing machines (304 tons—492 tons).

ARGENTINA AS A MARKET FOR ELECTRICAL MATERIAL.

In a report to the Department of Trade and Commerce at Ottawa, dated January 17th last, Mr. B. S. Webb, the Canadian Trade Commissioner at Buenos Aires, gives a good deal of useful information with regard to the market in Argentina for electrical material. During the year 1920, imports were worth approximately $4,700,000, reckoned according to officially assigned values at 1906 prices, or more than double that amount at existing prices. German manufacturers formerly supplied Argentina with one-half of her requirements in electrical material, one-third of the trade going to the United Kingdom, and about 5 per cent. to the United States and Italy respectively. During the war an increasingly large share of the trade was secured by United States manufacturers until the year 1917, when half of the goods imported were of American manufacture, the United States thus replacing Germany rather than England or Italy in the Argentine market. Since 1917 no detailed statistics have been available regarding the origin of imports, though it is well known that the hold of the United States on the market has been considerably relaxed.

The Argentine market for electrical material is a highly competitive one, foreign manufacturers evidently using it as an outlet for surplus production. That electrical material is sold in Argentina, if not at cost, at least on a very small margin of profit, is apparent from the following examples of close c.i.f. Buenos Aires prices: a porcelain two-pin surface receptacle, with plug, at 8/10 cents Canadian; a flush wall receptacle at 42/60 cents; a Bergmann surface switch at 8 cents; a H-H type switch at 21 cents; a flush wall switch at 34/64 cents. Although there are a few cases in which manufacturers ship to their representatives on consignment (and this mostly applies to incandescent lamps), business in electrical material is usually carried on through manufacturers' representatives who call on importers, book orders for goods to be shipped direct to the importer and paid for on the terms which his credit rating entitles him to receive, ranging from cash against documents to delivery of documents against acceptation of drafts of from thirty to ninety days' sight. In addition to the manufacturers doing business through local agents, the large electrical combinations known as the General Electric Co. (U.S.A.), the Western Electric Co., the English Electric and Siemens Co., and the General Electric Co., Ltd. (London), operate branches in Argentina, carrying stocks from which the wholesale and retail trades and consumers are supplied; the Metropolitan-Vickers Co., Ltd., is reported to be about to begin operations. It is estimated that there are some 2,000 dealers in electrical material in business in Buenos Aires, Rosario, Cordoba and Bahia Blanca, of which number 115 possess a credit rating entitling them to be considered as importers.

Ten years ago the trade demanded German types of accessories, but during the war, German electrical material being unobtainable, dealers were obliged to stock American goods, with the result that the consumer, through force of circumstances, has now become accustomed to comparatively high-grade accessories of American and English manufacture. In all new buildings wiring is carried in buried steel conduits, and flush wall receptacles and flush switches are used in place of the old surface types. Certain well-known American types of fittings are now considered as standard types, and it is a significant fact that, while German fittings are again being offered in large quantities and at very low prices, the types offered are better than those supplied before the war, and in some cases are almost exact replicas of American types; the German quality, however, is below pre-war standards. English electrical material is considered good, but not the best, the designs being too heavy and prices too high.

Wire and cables are imported into Argentina during a normal year to the extent of 8,000 tons. This commodity is divided for Customs purposes into three classes: transmission cables for public works, duty free; insulated wire and cable five millimetres diameter and over, 7 per cent.; insulated wire and flexible cord of a diameter less than five millimetres, 32 per cent. Among British concerns supplying are the British Insulated and Helsby Cables, Ltd., and W. T. Henley's Telegraph Works, Co., Ltd. There is not much sale for lead-covered wires.

Electric motors are used for power purposes to the almost complete exclusion of steam and other power. Most of the motors imported are for use in connection with repair shops, printing works, clothes-making and similar establishments; the majority used being therefore of small sizes, ranging from ¼ to 30 h.p. Motors are also required for raising water to roof cisterns on all buildings 70 ft. or more in height, the pressure of the mains not being sufficient to raise water to a higher level; centrifugal pumps with a lift of 60 metres, direct-coupled to high-speed motors of from 1 h.p. to 5 h.p., are used for this purpose. Motors wound for direct current are imported in sizes up to but not including 3 h.p., and may be for 220 volts; 3 h.p. and over must be for 440 volts. Motors wound for alternating current must all be for three-phase, 50 cycles at 225 volts. There has been an exceptionally brisk demand for ½ to 1½ kW, 32-volt farm lighting sets, and as many as twenty English and United States manufacturers are now competing for this trade. The most usual installation consists of a 3-h.p. petrol motor direct connected to a 1½-kW direct-current shunt-wound generator, switchboard usually mounted on engine base, semi-automatic arrangement preferred. With the above set a battery of from 180 Ah to 280 Ah is employed.

Imports of lighting fixtures have fallen off considerably during recent years, and now amount to some 90 tons per annum as compared with a pre-war average of 500 tons. English and American designs, being less ornamental than the French types popular in Argentina, are not considered suitable for house lighting, but are used fairly extensively for shop and office lighting. Many of the English designs cannot be made locally to advantage, and there will always be a certain limited demand for these.

Electricity meters are now imported almost exclusively from the United States, the type used being the motor type, such old types as electrolytic meters having disappeared.

Incandescent lamps worth at present prices about a million dollars are imported annually, being sold on a very small margin of profit, with the keenest competition between manufacturers of the different producing countries. The lamp most widely sold is the Philips, made in Holland. A feature of this market is the fact that the several brands of lamps are extensively advertised, and the consumer usually asks for a given brand of lamp when purchasing. "One-watt" and "half-watt" lamps in sizes under 100 candle-power are supplied in proportions of 70 per cent. and 30 per cent. respectively; over

100 candle-power, half-watts only are used. A 100-watt lamp is being sold from stock to-day, wholesale, at 76 Canadian cents, this price including factory cost, freight, insurance, Customs duties, landing charges, cost of exchange, and importer's profit.

Nearly all the lamp sockets used are of the German keyless type, brass and porcelain, Edison key sockets not being used to any appreciable extent.

Large numbers of electrical appliances, such as disk heaters, toasters, grills, radiator stoves and irons were formerly imported from the United States, but owing to the exchange situation the trade has been secured by the local industry.

Secondary batteries or accumulators were imported on a comparatively small scale some years ago, but imports have been increasing. Service stations have been established for Prestolite, Exide, and other makes of batteries, but a factor militating against the sale locally of batteries is the fact that most of the automobiles now being imported arrive equipped with self-starter and batteries.

The demand for fans has fallen off considerably, annual imports now averaging 2,000 per annum as compared with a pre-war average of 12,000. Two-thirds of the quantities imported are of Italian make, the balance being of American manufacture.

Before the war, Bergmann insulated brass-covered conduit was used to a large extent, but later fell into disuse as the size of buildings increased. Steel tubing then replaced the Bergmann to a large extent; there being two classes sold, the light gauge European types and the heavy-gauge American type, which are now sold in the following proportions: Bergmann 20 per cent., light steel 50 per cent., and heavy steel 30 per cent.

For street and public lighting arc lamps have been replaced to a large extent by gasfilled filament lamps, and the importation of carbons has declined from a pre-war average of 690,000 kg. to 180,000 kg. during 1920.

There is only one hydro-electric generating plant in Argentina; it is located near the city of Tucuman, to which point electric energy is conveyed for public buildings and for distribution, but the system is not a very large one. The various provincial lighting companies use high-pressure lines for feeding the smaller towns along their systems, but in general, the demand for large-size insulators for high-pressure lines is not very large. Small reel insulators, for interior wiring, spiked bell insulators, and reel or bell insulators for telegraph lines are imported on a very much larger scale, and there is quite a good demand for round and oval cleats.

PHANTOM TELEPHONE CIRCUITS AND COMBINED TELEGRAPH AND TELEPHONE CIRCUITS.

By J. G. HILL.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

The methods generally employed in the utilisation of telegraph and telephone circuits to transmit two or more electrical communications simultaneously without interference between them, fall under two heads: The impedance or retardation method and the equipotential method. The impedance method of simultaneous telegraph and telephone working applied to single-wire working was introduced by F. Van Rysselberghe, a Belgian, in 1882. Combined working is rendered possible by the different impedance of inductance coils and condensers, respectively, to high- and low-frequency currents. The action depends upon the fundamental difference of Morse signals and telephone speech currents. The mean frequency of voice currents is taken for calculation purposes as 800 periods per second. The duration of a Morse "dot" is taken as 1/12th second. If an electrical condenser of sufficient capacity is placed in series with a telephone receiver in an ordinary telephone circuit, the attenuation of speech currents is only just perceptible to the ear. The impedance to very low-frequency currents is, however, very high. If a suitable inductive impedance is placed in the line lead of a telegraph set the speed of telegraph signalling is reduced, but it is still possible to signal at hand speed. The reduction in the rate of rise of the telegraph signals reduces the normal tendency of those signals to cause disturbance in the telephone circuit, in view of the simple fact that the disturbing signals vary in intensity in proportion to the rate of change of voltage at the terminals of the condenser. The application of these principles in the Van Rysselberghe system is shown in fig. 1. RL is a high inductive impedance placed in the path of the telegraph apparatus, and C is a condenser in the telephone circuit, the two sets of apparatus being joined in parallel and connected to the line. In the illustration both ends of the line are shown. Owing to the changes in the permeability of the iron cores and the effective resistances of the telegraph apparatus with different current strengths, experiment is preferable to calculation. A mathematical study of the problem shows that the rate of rise in voltage is logarithmic, and by arranging suitable values of the resistance and inductance of the retardation coil, the capacity of the condenser, and the resistance of the non-inductive line, the rate of rise of voltage may be advanced or retarded. Although the more complex apparatus shown in fig. 1 causes modification of these effects, experiment shows that relatively high inductance in the retardation coil and condenser capacity give good results. It is not possible, however, by the arrangement of a condenser shunted by a long non-inductive line to eliminate entirely the disturbing effect of Morse signals upon the telephone circuit, due to the rate of change of voltage at the condenser terminals. The retarding device RL, shown in fig. 1, does not protect the superimposed telephone apparatus in the same circuit from the disturbing influence of contiguous uncomposited telegraph circuits. The remedy is to place retarding devices in the circuits which cause the disturbance.

It is necessary to consider the effect of retarding devices upon the rate of telegraph signalling in aerial circuits. In a Morse-Wheatstone circuit a speed of 600 words per minute could be obtained in the most favourable circumstances, but it is preferred to work at a speed which can be maintained under all conditions, and 200 words is frequently selected, equivalent to signals of 1/80th second duration. The voltage rises to only about one-third of its maximum value in that time, and it is therefore impossible to add a heavy retardation in such a circuit. In practice, with the amount of retardation necessary to reduce the noise in the telephone, and bearing in mind the necessity for keeping the voltage of the telegraph circuit as low as possible for the same reason, 60 words per minute on an overhead line working duplex can only be obtained under the most favourable conditions. The Van Rysselberghe system is generally worked at hand speed. The introduction of a retarding device sometimes causes difficulty in balancing telegraph duplex circuits, and it is found in practice that if the windings of the retardation coil are joined up so as to oppose each other, balancing is much easier.

The ordinary ringing magneto-generator, with a low periodicity of about 17 periods per second, is liable to interfere with the telegraph apparatus. Some form of interrupter or buzzer is therefore generally used on composited circuits. The Western Electric Co. has developed a vibrating-bar generator with a natural frequency of 140 periods per second, which is used in conjunction with a bar tuned to the same frequency and actuated by currents which pass through bobbins wound on pole pieces on each side of the reed.

In this system a relatively poor circuit, unsuited for long-distance working, is usually obtained, but if the device is installed on a high-grade copper conductor the speaking range may be considerably increased. Since Van Rysselberghe's system many other devices to give the same results have been introduced, among which may be mentioned the "Phonopore" system of Mr. C. L. Langdon-Davies and the Turchi-Bruné system. The "Fullerphone" also occupies a prominent place. One of the many variations of the Van Rysselberghe system (one end only) is shown in fig. 2. In this a bridging coil is placed in series with the receiver. This apparatus suppresses noise by sacrificing efficiency.

Fig. 3 shows an arrangement for utilising the two wires of a double-wire circuit to form two duplex circuits; this is known as composited working. In this country the arrangement is sometimes used to superpose telephone call wires worked by telegraph, upon junction circuits worked on the common battery system (fig. 3), or, alternatively, one wire is used as a telegraph call wire, and the other for automatic signalling on the junction circuit. Simplex and composited sets have been used in this country for many years.

An example of the equipotential method of superposing is given in fig. 4. The relative transmission efficiency of side and phantom circuits in aerial lines depends essentially upon the arrangement of the wires on the poles. This efficiency is inversely proportional to the real part β of the complex attenuation constant $\beta+j\alpha$, and may be found by the following formula:—

$$\beta + j\,a = \sqrt{[(R + j\omega L)(G + j\omega C)]}$$

Where β=real part of attenuation constant; a=wave-length constant; R=effective resistance per unit length; L=effective inductance per unit length; G=effective leakance per unit length; and C=effective capacity per unit length. The transmission efficiency is also affected by the impedance of the circuit. In the case of an electrically long line, the quantity z_0 is usually known as the characteristic impedance; and

$$z_0 = \sqrt{\left(\frac{R + j\omega L}{G + j\omega C}\right)}.$$

The minimum attenuation constant in unloaded circuits is theoretically attained when LG=CR. As a general rule, the transmission efficiency of a circuit is improved by separating the wires more widely, because the normal capacity of a cir-

cuit, as compared with its inductance, is in excess from the point of view of the capacity and inductance required to produce the minimum attenuation constant. But, unless the circuit is perfectly balanced, the separation increases inductive disturbance from sources outside the superposed four-wire system. If the four conductors of a phantom-circuit combination are arranged on the pole arms so as to form a square as seen end on, the side circuits being the diagonals of the square, it can be shown theoretically that the relative values of capacity and inductance of side and phantom circuits are such that the capacity of the phantom circuit is more than twice that of the side circuit, and that the inductance of the phantom circuit is somewhat less than half that of the side circuit. It follows that the transmission efficiency of the phantom circuit is a little less than that of the side circuit. In the case of four wires arranged at equal horizontal distances on the same pole arm, the two side circuits being formed of adjacent wires from left to right in each case

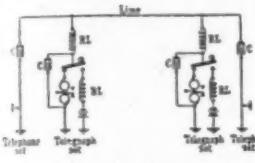


Fig. 1.

Fig. 2.

Fig. 1.—The Van Rysselberghe System.
Fig. 2.—A Variation of the Van Rysselberghe System.

and crossed at equal intervals, it can be shown that the inductance L of the phantom circuit is greater than one-half of that of the side circuit, and that its capacity is less than twice that of the side circuit. As a consequence, verified in practice, the phantom circuit has a lower attenuation.

The relative transmission efficiency of side and phantom circuits in unloaded underground circuits of the multiple twin type in air-space cables follows the general rule. Owing, however, to their closeness, the capacity is relatively much larger and the inductance smaller than in aerial wires, with a consequent lowering of efficiency. Experiment upon recent cables shows that the capacity of a phantom circuit is approximately 50 per cent. in excess of that of the side circuit.

It is possible to carry the principle of "phantoming" further and to obtain a second circuit by combining two four-wire cores and twisting them together in the same way as the two side circuits are twisted in order to form an ordinary phantom circuit.

The capacity of gutta-percha-insulated submarine cables is easily calculated. Owing to their immersion, the four wires of such cables are screened, and this simplifies the capacity relations. As a consequence, a metallic-loaded phantom circuit has approximately the same efficiency as the side circuit. The earthed phantom circuit, however, is materially less efficient than the other two circuits owing to the increased effective resistance.

It is possible, under favourable circuit conditions, to combine the two arrangements shown in figs. 3 and 4. For this

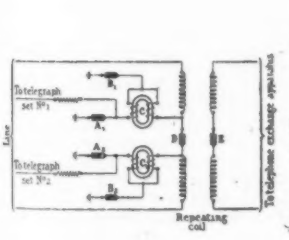


Fig. 3.

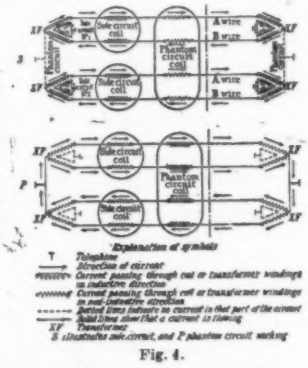


Fig. 4.

Fig. 3.—Two Duplex Circuits on a Double-wire Circuit.
Fig. 4.—Loaded Side and Phantom Circuits.

purpose the telegraph sets arranged as in fig. 3 may be added to the ends of the two side circuits in fig. 4. In order to secure a balanced arrangement, it would be necessary for all the telegraph instruments to have the same impedance at the same end of the line.

Transformers in phantom circuits have to meet special requirements which make their design difficult, but the Western Electric Co.'s "Type 4006 A" has been found very suitable.

When a phantom circuit is loaded, a separate and extra coil is usually required at every loading point, as shown in fig. 4. The coil is so arranged that a current sent round each side-circuit coil in an inductive direction passes round the two halves of the phantom-circuit coil in opposite directions. A current flowing in the phantom-circuit coils in an inductive direction passes through the side-circuit coils in a non-inductive direction.

In practice, the relative efficiency of transmission of the side and phantom circuits is also largely determined by commercial considerations, such as the economic spacing of loading coils. Owing to the indeterminate nature of the frequencies entering into speech, it is necessary to experiment to find the widest permissible spacing. The rule hitherto obtaining in Great Britain is: $C D L = 25$, where C is the capacity of the cable circuit in microfarads per mile; D is the distance in miles separating the coils; and L is the inductance of the loading coils.

In order to balance a loaded phantom circuit, the potential in the A and B wires (fig. 4) must be equal at all frequencies, and, unless the impedances of these lines are equal at all points equidistant from the sending end, the exceeding of the limits of overbalance will result in overhearing. In order to secure a perfect balance, the resistance, capacity, inductance, and leakance of the four wires must be theoretically equal. Resistance and leakance can be controlled to a large extent in manufacture, but special steps have to be taken with regard to capacity. Each four-wire core in a cable is balanced in short lengths, and the complete unit taken for independent balancing is a loading-coil section, present practice favouring lengths of 1.6 and 1.125 miles. Each loading coil section is divided into lengths of 0.1 mile, and these are tested separately and combined with other similar lengths to produce the best results in the loading-coil section. The capacity system of a four-wire core may be represented by ten capacities between different wires, and between wires and earth, and it can be shown that from six capacity measurements the necessary combinations to avoid overhearing and cross-talk can be deduced (fig. 5). These measurements are made by means of a double-bridge specially designed for use on the road. Apparatus is also designed for the rapid measurement of the

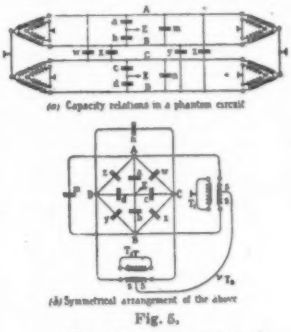


Fig. 5.

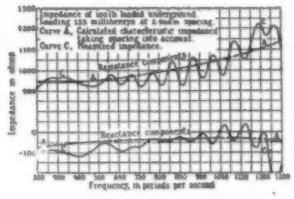


Fig. 6.

Fig. 5.—Capacity Relations in a Phantom Circuit.
Fig. 6.—Variation of Impedance with Frequency.

degree of equality of the resistance of the conductors. As regards resistance unbalance, there is no fixed rule, but experience shows that the difference in resistance of the A and B wires, expressed as a percentage of the loop resistance, does not usually exceed a mean value of 0.05. The question of capacity balancing has received considerable attention in America and Germany. Messrs. Siemens & Halske have patented a process for balancing capacity in cables by the addition of small condensers to the conductors at suitable distances. The condensers are made of rolled paper, sealed in glass tubes and joined in the cables at loading points. They may be enclosed in separate iron boxes or in loading coil pots. Professor F. Breisig has arrived at the conclusion that overhearing in short lengths of uniform cable is essentially due to capacity unbalance, and that speech tests may accurately determine its magnitude if a suitably designed artificial cable is used.

The characteristic impedance of a loaded line is generally different for every frequency, but notwithstanding this a comparatively simple balancing network can be designed which involves capacity, inductance, and resistance, and which effectively balances the differential transformer and circuit if certain conditions are fulfilled. The network is constructed to balance the circuit for a range of frequencies between 460 and 1,430 periods per second. Filters are necessary to cut out frequencies outside the range for which the circuit is balanced. Fig. 6 shows a calculated impedance curve of a loaded circuit in dotted lines, and the result of the measured impedance over the same frequency range is given in solid lines. The difference is due to the want of uniformity of the circuit constants. The circuit dealt with in fig. 6 was designed for pre-relay conditions, but such a circuit is not sufficiently uniform to give the results required in highly efficient relay working. It is necessary to specify limits to the permissible variation of (*a*) the spacing distance of the loading coils, (*b*) the inductance of any coil from the mean value of inductance per coil, and (*c*) the capacity of any loading coil section from the mean value of capacity per section. Leakance and resistance do not cause appreciable difficulty as regards present requirements of network impedance balances. The requirements as regards inductance in this country are that the

inductance of any coil must not vary from the mean inductance of each coil by more than 2 per cent. The loading coils must be spaced at intervals which do not vary more than 2 per cent. from the mean spacing distance. The limits of variation of capacity have not been fixed in this country, but German experiments show that this should not be more than 2 per cent. from the mean inductance per section, and that the electrostatic capacity per section should not vary more than 1½ per cent.

In conclusion, the author states that the ultimate object is to find that combination which for a given number of years will give the required overall efficiency at the most economical cost. In an appendix some particulars of electrical filters are given. The methods of determining the relevant quantities and calculating transmission properties are dealt with.

Discussion in London.

Sir Andrew Ogilvie, in opening the discussion, spoke of the historical and commercial aspects of phantom circuit systems. The Van Rysselberghe system did not lend itself to ordinary exchange systems, and it had only a limited application to long-distance work; its best field was in railway signalling and for using small telegraph offices for telephony. As the telephone and telegraph services in this country had been instituted by separate authorities the Van Rysselberghe system had not been used to a great extent, although in America this and similar systems had been used for newspaper and business offices. Composited telegraph circuits superposed on telephone trunk lines had enabled a good deal of telegraphing to be carried out at low cost. The Post Office had also been successful in superposing phantom circuits on submarine cables. The development of thermionic valves would probably give a new lease of life to the system, as it might be applied for long-distance communication, thus effecting a considerable saving of copper.

Mr. S. A. Pollock said that the limitations of the Van Rysselberghe system were fundamental, and would retard much further development. Mr. Hill had presented an admirable mathematical treatment of the subject, but the speaker thought that a great deal depended upon experiment. Resistance was a factor of success, and could not be replaced by an ordinary inductance; it was easier to find a resistance without short-circuiting tendencies than an inductance with the same advantage. Although the Van Rysselberghe system could not be much further developed, the application of phantom telegraph circuits upon telephone lines had not reached its maximum development. If the method of generating a pure sine wave or half-wave had been available some years earlier it would have done away with impeding apparatus; it would have only been necessary to separate the telephone and telegraph circuits by a telephone transformer. The only restrictive condition was that the system involved a constant frequency. The bar to phantom circuits was the fundamental difficulty of keeping the circuits entirely separate.

Mr. A. B. Hart said that in investigating interference between two circuits, telephone and telegraph, coupled by a condenser, they found that they were dealing with a rapidly-oscillating, high-frequency current. He wished to know what was the minimum frequency which could be used to give satisfactory telephone working. The author had said that increasing the inductance above the theoretical value of one-half that of the side circuit gave a phantom circuit having a lower attenuation constant, and therefore a higher transmission efficiency, than the side circuit, owing to the relatively smaller capacity of the phantom circuit and its higher degree of loading. Should not the words "relatively lower resistance" be used instead of "relatively smaller capacity"? Referring to Mr. Hill's description of methods for obtaining balanced circuits, the speaker said that they often had to couple a balanced to an unbalanced circuit, this efficiency then proved a disadvantage. It was sometimes better to sacrifice a little transmission efficiency in order to avoid carry-over currents.

Mr. A. E. Thompson stated that combined phantom and composited circuits had been used in Denmark for some time, there being such lines from Copenhagen to five distant places. In France, during the War, the American Army had used the method. The Bell companies of America had 700,000 miles of circuits, and 90 per cent. of these were composited. The system was also in general use upon the American railroads. The P.O. arrangement shown in the author's fig. 7 had many disadvantages, including condensers of too high capacity, and no protection against "cross-fire" between circuits.

The President, at this point, introduced Mr. S. Imada, of the Japanese Government Department of Communications. This gentleman, who was received with acclamation, expressed his pleasure at being able to attend a meeting of the Institution and his thanks to Mr. Hill for his paper.

Mr. W. J. Thorrowgood spoke of the use upon railways of the systems dealt with. The superposed circuits, he said, were not so delicate as might be thought. He instanced a case where, in a length of 76 miles of single line, there were 14 telegraphs and 15 telephone instruments, and speech could be transmitted from one end to the other; this showed the capabilities of the system. The example quoted had been in use for a great many years and the couplings between circuits were extremely simple. Mr. Thorrowgood also gave some particulars of the system between the Southampton and Waterloo stations of the L. & S.W. Railway.

Mr. C. Robinson said that the author had mentioned the lack of automatic signalling, but the progress of Post Office research in this direction had been held up by the War. The first consideration in the design of filters was the cut-off point. This could easily be calculated if the inductance and capacity were known and the resistance could be adjusted.

Mr. G. C. Marriss asked if machine telegraphs had been employed in this country on these circuits, and also what was the maximum signalling speed which had been found practicable. He wanted to know if much difficulty had been encountered in balancing, for relay purposes, different phantom circuits in the same cable. Could not valve relays be used instead of filters in the telegraph circuit?

Capt. F. Reid said that filters would cut off frequencies above 2,000 but not those below. If audible speech could be obtained at a frequency of 1,400, why not space out the loading coils and save money? He considered that cable manufacturers should standardise capacities for special types of cables.

Mr. Hill, in replying, said that Mr. Pollock had stated that resistance was necessary, but he (Mr. Hill) thought that it was not essential. He had been astounded at the small size of condenser necessary to obviate telegraphic induction. Mr. Hart had questioned his statement regarding transmission efficiency, but he (the author) meant exactly what he had said. The resistance could not vary, it was the variation of capacity which gave the effect. The system used by the American Army was merely a secret method, and not worthy of a great deal of attention, but he was interested to hear of the Danish developments mentioned. He agreed that the technical terms used required re-arrangement. The rest of the author's reply was reserved for publication in the Institution *Journal*.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Employers' Agreements.

The reply given by the secretary of the B.E.A.M.A. with regard to the practice amongst certain groups of firms of not taking each others' employés is what one would naturally expect. No more weight can be placed on this statement than that such understandings are not recorded on the minutes of any B.E.A.M.A. meetings, and no one would expect them to be. That understandings of the sort exist, however, in certain groups of firms is only too obvious.

For instance, when the shares of one company are held by another the management would view the application of a member of the staff of the controlled firm in the light of a transfer to be made by mutual agreement. It is only a step from this to the same understanding between a large group of firms in a modern combine. The trouble, however, does not stop there, but has invaded associations of firms where one would have expected a different state of things as the members belong to different financial groups.

April 29th, 1922. **"Castor."**

Regarding the footnote to the letter of "Pollux" in the current Electrical Review, I should like to say that while I have no doubt the secretary of the B.E.A.M.A. can find no trace of such a practice as is indicated by your correspondent, yet, if he were to join the outside staff—I can only speak as I know—of one of the associated cable makers, he would find exceedingly great difficulty in transferring his services to another of the associated companies. In fact, during twenty years' experience of cables, I have not known of one man—foreman, jointer or engineer—who has moved directly from one of the companies to another. Further, it is well known by the staffs of at least two of the large cable companies that there is not the least chance of securing a position with a "rival" firm.

C. G. Watson.

London, *April 29th*, 1922.

Finding Faults.

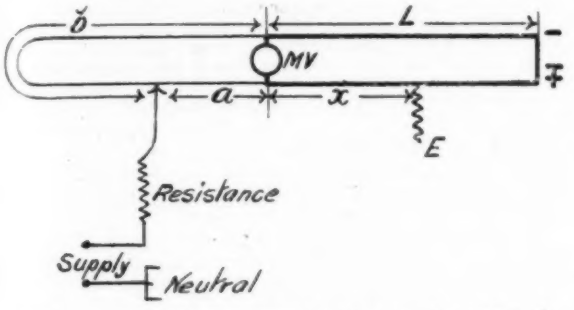
A mains department in which the only instrument available for testing is a millivoltmeter, is very ill equipped, but, assuming that your correspondent "Colonial" has wire of some sort to use for connections, something can be done to locate the faults—no doubt numerous on his unbonded lead system—of the kinds mentioned in the last two of his categories.

Regarding the first case, in which all the conductors are earthed, the most certain and generally the quickest and cheapest way of finding the fault is to cut the cable into two approximately equal lengths; cut the faulty one of the two lengths thus made into two, and so on until the fault is located to as short a length as it is considered advisable to relay.

Case 2, in which the neutral conductor is earthed, can be dealt with by a method which has already been outlined in

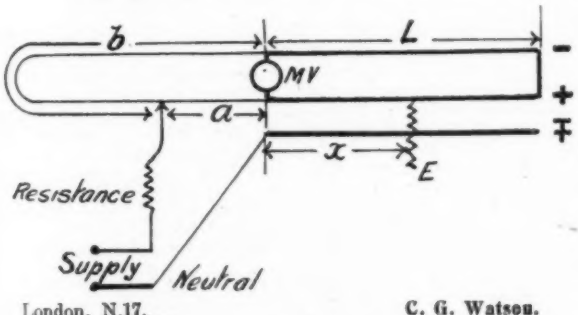
the ELECTRICAL REVIEW (see "Correspondence" columns, issue of March 31st last), but which will now be described in a modified form in order to meet the different conditions of this case. This is it:—At one end of the faulty cable, make a sound connection between the neutral and, say, the negative conductors. At the other end, connect the same two conductors by means of any convenient length—ten feet will commonly be found both convenient and sufficient—of wire; across the ends of this wire connect the precious millivoltmeter; to the positive, or negative, of the supply connect one terminal of a resistance—a filament lamp will do; but, if one is found insufficient, others can be added in parallel with it—the other terminal being connected by means of a flexible lead to a point on the loop wire such that no deflection is observable on the millivoltmeter after contact has been made a few seconds. Then, the position of the fault is given by the equation, $x = 2aL/(a+b)$, where x = the distance of the fault from the testing end, a = the length of loop wire from the faulty neutral conductor to the point of balance, b = the length of loop wire from the negative of the faulty cable to the point of balance, and L = the length of the faulty cable.

From what has been written above, the following diagram can be understood:—



It is assumed that the neutral of the supply system is already earthed, but if this is not the case, then it should be so while the test is being made. It is also assumed that the negative and neutral conductors are of equal cross-section. If such is not the case a correction will have to be applied. This is easily done by making L in the above equation equal to $l(c/d+1)$, where c=cross-section of neutral conductor, d = cross-section of negative conductor, and l = length of cable.

Case 3 can be dealt with similarly to case 2. That is to say, in the present case the neutral, positive and negative should be treated as earth, neutral, and negative of case 2. The diagram below will perhaps make the arrangement clear.



London, N.17. **C. G. Watson.**
April 29th, 1922.

The Mangnall-Irving Thrust-Borer.

I have read with considerable interest the article in your issue of April 21st entitled "An Improved Method of Cable Laying," by using the Mangnall-Irving Thrust-Borer. It appears to me that the title "An Improved Method of Cable Laying" is, to say the least, misleading.

The method of cable laying described appears to be only applicable to one particular case, *i.e.*, when it is required to lay an iron pipe into which cable is to be drawn, and even in this case "caulked" or "lead joints" in the pipe to be laid would be most difficult, if not impossible.

The bulk of the power and lighting cables of to-day are lead-covered armoured cables, and these should be protected from external mechanical damage by being covered with tiles, bricks, or a creosoted wood board, which could not be achieved when using a thrust-borer.

If plain lead-covered cables are used, which is the exception rather than the rule, then they should be either laid "solid," in which case the thrust-borer machine would be useless, or drawn into pipes or ducts.

The majority of engineers use earthenware ducts in preference to iron pipes, so that the use of the thrust-borer is extremely limited as far as cable-laying is concerned.

I know it is easy to criticise, but I am looking at the matter from the mains engineer's point of view. Doubtless, for laying iron and steel pipes, if the jointing of these is of no importance, and lead water services, &c., the use of the thrust-borer may be useful and cheap, but I fail to see that this method can appreciably reduce, much less eliminate, the trenching, &c., that is a necessary part of present-day cable-laying.

F. O. Trotman.

Sheffield.
April 28th, 1922.

Private Electricity Supply.

I should be pleased if you or any reader of the ELECTRICAL REVIEW could furnish me with particulars regarding the following matter:—

A party who is the owner of about twelve houses wishes to install a lighting plant to supply current to this property. The houses are at present supplied with gas, and the question arises: is he in order in doing this, and charging by meter, or a fixed yearly premium, or by adding a sum to the yearly rental of the houses? The Corporation electricity main runs within half a mile away, but they do not intend laying the cable up to these houses. Could the gas company take proceedings, seeing that they have the right of supply?

Lighting.

April 26th, 1922.

[The gas company has no voice in the matter. The owner, however, is unable to commence a supply of electrical energy for sale, as we gather from the letter that the Corporation possesses statutory powers to supply electricity in the area, and it is immune from competition. He should apply to the Corporation and to the Electricity Commissioners for permission to supply electricity to his tenants.—EDS. ELEC. REV.]

Municipal Electricity Works Costs.

With reference to the article by "Interested" in your issue of April 21st, I venture to make one criticism.

True "costing" necessarily involves ascertaining what is the actual cost, and therefore the practice of adjusting certain overhead charges from time to time to meet a varying load at different seasons, though expedient, cannot really be said to represent the true cost of the output produced over a given period.

London. **E. Williams.**
April 29th, 1922.

The Industrial Situation in Russia.

I read with much interest the article "The Industrial Situation in Russia," published in the ELECTRICAL REVIEW of April 21st. On the third page of this article I find, however, a statement attributed to Mr. Gurewitsch, an engineer of Zurich, which is probably due to a typographical error. The statement says that in 1913 14,300 dynamos and motors were manufactured in Russia for a total capacity of 34,000 kW, and that Germany's imports of electrical material into Russia in 1913 amounted to £17,000,000 at pre-war gold value. Both these figures are wrong. The total capacity of dynamos in motors manufactured in Russia in 1913 amounted to 356,000 kW and the average German imports into Russia for the years 1912 and 1913 amounted to about £1,500,000. Both these figures are from official statistics. You will agree with me that five factories with over 6,000 workmen should be able to turn out a little more than 34,000 kW per annum.

On account of the Custom tariff very few machines, except the quite small ones, say up to 25/50 h.p., could be imported into Russia. What Russia imported from Germany was mostly lamps, fittings, instruments, insulating and wiring material, electric lighting supplies, switchgear, &c.

A Reader.

April 28th, 1922.

Colouring Lamp Bulbs.

Referring to your Service Department Notes, on page 378, of March 17th, 1922, No. 2,312, you ask for manufacturers of yellow lacquer for lamps. It may be of interest to you to know of a way of colouring lamps I came across in a book of practical receipts, some years ago, and have always found very successful, and the ingredients can be obtained anywhere.

1. Prepare the bulbs by washing carefully in soap and water, taking care not to finger them afterwards.
2. Prepared bath made of white of egg and water in the proportion of two whites to one pint of water; beat well, let it settle and filter.

Then dip the lamps in and hang up to dry.

3. Dissolve aniline colours in ordinary photographer's collodion; I use ether collodion.

The colour can be made as deep as required; it is preferable to have the colour on the light side and dip more than once if necessary.

4. Red and blue give a clear solution; green, thick, which requires filtering; yellow dries pasty, but gives better results than if clear.

5. Combinations of colours can be made up and I have painted with an ordinary brush flags of nations.

I have used this for Christmas tree lamps, which have been in use several years now and the frosting and colouring is still in fair condition.

6. Current should be passed through the lamps when apparently dry to harden the coating.

Batti Wallah.

Calcutta, *April 12th*, 1922.

Joints Behind Switches.

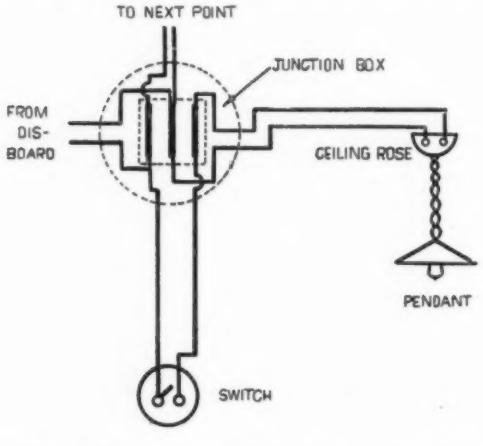
Your correspondent in the issue of the 14th inst. refers to the desirability of switch manufacturers affording facilities at the back of switches for negative wire connections, to obviate joints being in the negative wire behind switches, especially in twin lead-sheathed wire. Such a method of dealing with the matter would not meet with general approval. It is quite easy to loop the positive through the switch without cutting the negative, and at the same time provide continuity for earthing the sheathing. A more serious matter and hard to detect is the "nicking" of conductors by careless workmen when trimming ends of cables for making connections, also cutting into the insulation when cutting around lead sheathing in trimming. Hundreds of plants are running at unknown risks to-day from this cause. If the contractors and the trade unions could combine to raise the standard of workmanship, it would help the trade enormously.

Faraday.

April 25th, 1922.

Mr. Coleman's suggestion of a three-terminal switch in your issue of April 24th has been met with the expected reply in your last issue, that such switches are on the market, and also with the suggestion that a three-plate ceiling rose offers a useful alternative.

In cases where it is more convenient to loop the "feed" with the "feed to the next point" near the switch than near the ceiling rose, we recommend on our wiring system the use of a "W.S. 1007" junction box at about ceiling level above the switch, and the connections shown in the diagram herewith. In this way twin cable is used throughout, all the looping being done at junction boxes placed in the most convenient positions; one cable instead of two is brought down to the switch; and the three-terminal switch, which brings both poles near together under a cover which can be easily removed by the consumer, is avoided.



Incidentally, the value of the cable saved by shortening the distance to loop back practically pays for the cost of the junction box.

F. Charles Raphael.
Manager, Cable and Wire Dept.,
Edison Swan Electric Co., Ltd.

Ponders End, *May 1st*, 1922.

Replying to the suggestion made by Mr. Martin J. Coleman in your issue of April 14th (p. 519) we would state that such a switch as that suggested, namely, an ordinary switch with an extra terminal for looping, has formed a part of the Henley wiring system for many years.

W. Bishop,
Manager, Sales Dept.
W. T. Henley's Telegraph Works Co., Ltd.

London, *April 26th*, 1922.

A Question of Courtesy.

I wonder if the Editors or subscribers to this Journal can advise the writer why one so rarely obtains the "courtesy" of a reply from the architect or consulting engineer, in the case of applying to tender on contracts advertised in trade journals.

My firm has an excellent system of following up in these cases, and always we enclose an addressed reply card, often stamped, yet rarely do we receive it again.

Application to tender is not an advertisement, and surely a reply is due—even if the tender is already cut and dried before publicity.

The point seems to me one of lack of co-operative courtesy as between the professional and contracting sides of the building and contracting trade, which is not helpful to the contractor in keeping his advertising and correspondence in that order it should be kept in a well-run business.

Advertising and Publicity.

London, *April 29th*, 1922.

Rats v. C.T.S.

I have no financial interest in C.T.S. Your previous correspondents, "Disgusted" and "Completely Disgusted," do not make similar disclaimers regarding all C.T.S. rival systems of wiring. Had they done so one could only regret such sloppy sentiments as they express.

Do they sympathise with these "dumb creatures" who regularly attack sleeping children, for instance?

To test a fact of immense value to the community generally, and to the electrical industry in particular, are we to weep for the hunger of one rodent or invite the aid of the R.S.P.C.A.?

To insult any respectable firm by saying they are "stooping to boost business" and "torturing dumb creatures (sic) for filthy lucre," is, in my opinion, much greater cruelty and grossly unfair, particularly when it is done anonymously through your columns, and with your sympathy added.

H. C. Crews.

Manchester, *April 24th*, 1922.

[The correspondents referred to were not, so far as we can judge, connected with "rival systems."—EDS. ELEC. REV.]

I am in thorough agreement with "Fairplay," and "An Englishman," and, in so far as memory serves, with "Disgusted," and "Completely Disgusted," also.

May I point out to "Sense of Proportion" that because men are dying of starvation is no justification for the starving of a rat; the fact that millions of men are leading a precarious and penurious existence at the present moment is only a sign of the imperfect organisation of society—it is also a sign of the selfishness of the society when so many of them have recently suffered for their countrymen—but the torture of "an unloved rodent" is a sign of a cruel and savage temper, which would only be tolerated in an inhuman or uncivilised society.

Mr. Brooking's second query has no bearing on the fundamental point at issue and can safely be ignored, but his first query could certainly be answered. However, I, for one, am not prepared to help anyone who attempts to uphold a typically unintelligent and soulless commercial but contemptible procedure.

C. G. Watson, M.I.E.E.

London, N.17.
April 29th, 1922.

To my mind the cruelty of the experiment described in the recent advertisement of Messrs. The St. Helens Cable Co., lies in the futility of that experiment.

A rat will gnaw its way through wood and sheet lead, and I have experience of breakdown of cables due to the lead sheathing being damaged by rats, but surely if a rat is imprisoned with a piece of wood and a piece of lead as its sole means of support, it will die of starvation? These things are not a diet, but are damaged either because they are in the way, or the rat requires the material for some other purpose.

Thus, I think, the St. Helens experiment proves nothing.

Had the experimenter put a well-nourished rat into a box made of C.T.S., with due regard to ventilation, and placed a supply of food on the outside of the box, I am of the opinion that the result would have been different.

Francis Thos. Fawcett.

Woodford Green,
April 29th, 1922.

Replying to Mr. Brooking's invitation to show in what other way the question of C.T.S. and "Rats" could have been settled, I have to indicate the probability that if Mr. Brooking had also placed some lead-covered cable through the cage bars he would have found it untouched. I have specialised in twin lead-covered wiring since 1897, and have not come across any evidence that lead-covered cables are eaten as a food, but have in mind several cases where they have been attacked in places where the wires formed an obstruction in a "run." Their replacement in a slightly different position has, in the cases I have met with, resulted in a cessation of the trouble. Curiously, I had a case reported on the 22nd April, where a lead-covered twin cable had been gnawed through, and I have taken the opportunity to have it replaced by C.T.S. in exactly the same position. In this case there is no question of food—the wires are in the ceiling space under a loft floor, already almost full of oats, which have run through rather wide joints in the boards. I will report the result in a week or two, and suggest that this is

a much better test than the one which has aroused such widespread indignation.

Experiments involving pain and terror to animals should only be conducted under the same strict regulations as those coming under the heading "Vivisection," and it should be a condition precedent to any experiment that its imperative need is certified by the Council of the Institution of Electrical Engineers.

This is my first letter on the subject.

W. Fennell,
Engineer and Secretary.
Northwich Electric Supply Co., Ltd.

Northwich, *May 1st*, 1922.

As no exclusively advertising man has so far associated himself with the protest raised against the recent advertisement of the St. Helens Cable Co., perhaps you will allow me, as one who has for over 20 years been responsible for a very large volume of advertising, to add my name to those already received. Into the ethics of the experiment it is not necessary to enter, but the publication of the callous details in such a form is utterly repugnant to one's sense of good taste and good feeling, and to my mind, inexcusable on any ground, "scientific" or otherwise.

E. C. Reed.

London, *May 1st*, 1922.

My directors have to-day had their attention called to an advertisement which has appeared in your paper under the heading of "Rats *v.* C.T.S.," of which advertisement they had no knowledge prior to its appearance in the Press.

They were unaware of any such experiments being carried out at Warrington, and they have taken effective steps to prevent a repetition of any similar investigations.

They entirely disapprove of such experiments and of such advertisements, and desire me to express their regret that anything of the kind should have taken place.

H. Evans,
Secretary,
St. Helen's Cable & Rubber Co., Ltd.

Warrington, *May 2nd*, 1922.

[Several other letters on this subject have been received, differing little from those inserted. We think the matter has now been adequately discussed and that no useful purpose will be served by prolonging the correspondence.—Eds. Elec. Rev.]

British and German Instruments.

A second draft of the German V.D.E. specification for electrical measuring instruments, which is to come into force next year, has just been published, and it may be worth while to compare it with the corresponding B.E.S.A. specification, No. 89.

It is quite clear that the German document is modelled upon the British specification—several of the requirements are identical, and where they differ the British is, in nearly every case, the more stringent of the two. German instruments are divided into four classes as against our three—the first two classes (E & F) differing but little from one another, and corresponding roughly with our "Sub-Standard." The requirements of their industrial instruments (classes G & H), on the other hand, are definitely inferior to our first and second grades. Not only is this the case as regards general accuracy, but the allowable disturbance by stray magnetic fields may be cited as being at least double that in our specification, for the corresponding classes. The same applies to the dead-beatness called for, which is little more than half as good as the B.E.S.A. requirements.

I think it worth while to draw attention to this very definite superiority of instruments complying with the British Specification since, with our usual love of self-depreciation, it has often been stated that our Specification was less rigid than those of other countries. As far as I am aware no other country has issued such a specification, with the exception of the present German one, which certainly does not bear out this contention.

In one or two directions, innovations have been introduced which are, I think, useful, as, for example, the expression of the accuracy of all classes of deflectional instruments as a percentage of the maximum scale reading, instead of as a percentage of the reading itself, as is done in some cases in the B.E.S.A. Specification. Incidentally, it is laid down that if the instrument reads high the error is to be regarded as positive. The practice at the N.P.L. is the converse of this, and I feel that it is time this question was settled, one way or the other. Every instrument is required to bear a symbol indicating its working principle, such as "Moving Coil," "Hot Wire," &c. A repeated overload test, intended to discover mechanical weaknesses, has been introduced, and might well be included in the next revision of B.E.S.A. Specification 89.

The designers of electrical measuring instruments in this country have, evidently, little to learn and nothing to fear from this latest V.D.E. Specification.

Kenelm Edgcumbe,
Major.

London, *May 1st*, 1922.

PARLIAMENTARY NOTES.

(From our Parliamentary Reporter.)

Rating of Machinery.—On April 28th Sir J. Remnant moved the second reading of the Rating of Machinery Bill. He explained that the object of the measure was to make it clear that, in estimating the rateable value for purposes of local rates on any hereditament that might be used for trade business or manufacturing purposes, machinery should not be included unless fixed or attached to the hereditament. Clause 2 of the Bill defined the expression "fixed or attached" machinery as that which was so fixed that it could not be removed from its place without necessitating the removal of any part of the hereditament. There was no question, he said, that the whole of our system of rating was in such a muddle that no manufacturer knew where he stood. The systems in vogue varied with the large number of different assessment authorities throughout the country. He had heard of a case that day at Leeds, where there were four different assessment authorities with four different systems. To-day the manufacturers in England and Wales were at a great disadvantage compared with those in Scotland, Ireland, or, indeed, in any other country. One of the great causes of the present unemployment was due to the fact that many of our manufacturers had had to pay in State and local taxation alone more than their foreign competitors had to pay in labour plus standing charges. He instanced the case of a great engineering firm which, before the war, was rated at £8,759. It had been given notice by the Union assessor that he intended to increase the percentage of the capital value of the machinery, and that for the future it would be rated at £47,673! Over 60 per cent. of that valuation was due to the inclusion of machinery that would have been exempted in any other country. He failed to see why English and Welsh manufacturers should be thus penalised.

Sir Ion Hamilton Benn, who seconded, said that the rating of machinery penalised enterprise and efficiency. It encouraged the maintenance of old and obsolete machinery and the continuance of old methods. It was curious that we, who prided ourselves on being a business race, should be the only nation that made a manufacturer pay higher rates if he scrapped old iron and installed modern machinery.

Many other representatives of manufacturing and business interests supported the Bill, which, by 127 votes to 17, was read a second time.

The Engineering Dispute.—On April 27th, in reply to Mr. Clynes, who asked whether, now that negotiations in the engineering dispute had broken down, the Government would set up a court of inquiry, Mr. Chamberlain said: "His Majesty's Government have been most anxious that this calamitous dispute should, if possible, be settled by the parties themselves without Government interference, but the Government have throughout kept in touch with all parties to the negotiations, and have more than once succeeded in bringing them together again when a final rupture seemed inevitable. The special dispute on wages in the shipbuilding trade appears now to be in course of settlement, a basis of agreement having been arrived at for submission to the members of the unions concerned. No agreement has been reached, however, in the engineering trades on the questions related to managerial functions, and an extension of the lock-out seems inevitable. In these circumstances the Minister of Labour, on behalf of H.M. Government, has appointed Sir William Mackenzie to be a Court of Inquiry under Part II. of the Industrial Courts Act, so that the public may have an independent account of the character and limits of the question or questions in dispute."

[This subject is referred to in our leading columns and in "Notes."]

Empire Wireless Chain.—In the House of Commons, on April 26th, Mr. Hurd asked the Postmaster-General whether any, and, if so, what, replies had been received from the Governments of the Dominions and India respecting their attitude towards the Imperial Wireless Chain; and whether any of them, and, if so, which, had entered upon wireless projects of their own, independently of the Post Office scheme.

Mr. Kellaway, Postmaster-General, replied: "The only Dominion which has entered upon any wireless project of its own is Australia, whose representative at the Imperial meetings of last year reserved to the Commonwealth Government full freedom of action to decide in what manner it would co-operate in the Imperial Wireless scheme. The Indian Government has stated that it will have difficulty in finding funds to erect a high-power station of its own, and the position thus created will also be examined. Communications are proceeding with the Union Government and the Canadian Government is sending two representatives to this country to discuss the matter.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

10,674. "Electric storage batteries." Chloride Electrical Storage Co., Ltd., and B. Ford. April 13th.
10,677. "Apparatus for preventing operation of electric appliances on motor vehicles." Scintilla. April 13th. (Switzerland, May 20th, 1921.)
10,678. "Electric incandescent lamps, &c." S. J. Frost. April 13th.
10,683. "Ignition devices for internal-combustion engines." E. Urbain. April 13th. (France, April 14th, 1921.)
10,695. "Head lights for vehicles." A. L. Strange. April 13th.
10,700. "Electric apparatus for producing ozone." W. S. Graff-Baker and E. T. Brook. April 13th.
10,704. "Radio transmitting systems." E. F. W. Alexanderson and British Thomson-Houston Co., Ltd. April 13th.
10,714. "Circuit arrangements for electric relays." H. R. Wright. April 13th.
10,728. "Circuit-controlling devices for ignition systems of automobiles." D. C. Williamson. April 18th.
10,744. "Manufacture of electric incandescent lamps, wireless valves, &c." H. J. Osborn. April 18th.
10,754. "Electric switches." S. R. Gibbon. April 18th.
10,759. "Candle lamps." Wyncott & Sons, Ltd. April 18th.
10,791. "Electric fuses." J. A. Crabtree. April 18th.
10,796. "Electric pump." J. B. Belcher. April 18th.
10,798. "Sparking plugs, &c." F. J. Mills and G. H. Ward. April 18th.
10,808. "Power generator." W. J. Rodgerson. April 18th.
10,812. "Electrically-driven pumps." W. N. Cheyney, D. Maclachlan, and E. W. O'Hara. April 18th.
10,821. "Electric switches." British Brass Fittings, Ltd., G. N. Sperryn, and Sperryn & Co. April 18th.
10,835. "Electric seam-welding machines." E. Schröder. April 18th.
10,836. "Electric butt-welding machines." E. Schröder. April 18th.
10,837. "Electric heating and welding apparatus." E. Schröder. April 18th.
10,861. "Storage batteries." Safety Car Heating and Lighting Co. April 18th. (United States, March 11th.)
10,871. "Wireless telegraphy." G. Passarge. April 18th. (Germany, April 25th, 1921.)
10,886. "Selecting-devices for telephone systems." C. Rockley. April 18th.
10,887. "Inductance devices." Western Electric Co., Ltd. April 18th. (United States, May 21st, 1921.)
10,895. "Electric pocket-lamps." B. Rogge. April 18th.
10,903. "Radio-active tubes." Etablissements Gaiffe-Gallot et Pilon. April 18th. (France, May 24th, 1921.)
10,904. "Cable guide for cable drums." Compagnie d'Entreprises Electro-Mécaniques. April 18th. (France, May 6th, 1921.)
10,905. "Electric commutating switches." J. Bally. April 18th. (France, July 13th, 1921.)
10,919. "Lock for electric incandescent lamps." R. L. Rolfe. April 18th.
10,923. "Electric condensers." E. J. Halling. April 18th.
10,932. "Apparatus for automatically operating electric switches." W. Frisby. April 19th.
10,946. "Electrodes." R. F. Woodburn. April 19th.
10,953. "Ignition magnetos." W. Calder. April 19th.
10,967. "Connection of electric cables to electrical apparatus." F. B. Holt and Metropolitan-Vickers Electrical Co., Ltd. April 19th.
10,968. "Apparatus for regulation of gasfilled X-ray tubes." A. C. Gunstone and X-rays, Ltd. April 19th.
10,975. "Magneto-electric machines." H. Kaupmann. April 19th.
10,982. "Electrically-heated flat-irons." Orientex Handelsges. April 19th. (Germany, September 12th, 1921.)
10,987. "Electric switches." A. P. Lundberg, G. C. Lundberg, P. A. Lundberg, and G. Pegg. April 19th.
11,006. "Automatic traffic distribution for telephone systems." Compagnie Francaise pour l'Exploitation des Procédés Thomson-Houston. April 19th. (France, April 19th, 1921.)
11,007. "Suspension devices." British Thomson-Houston Co., Ltd. April 19th.
11,008. "Electrically-heated devices." British Thomson-Houston Co., Ltd. (International General Electric Co.). April 19th.
11,009. "Electric flat-iron." H. Baron (R. Frister Akt. Ges.). April 19th.
11,027. "Electric water-heaters." J. R. Quain. April 19th.
11,044. "Automatic step-by-step switches for telephone systems." Automatic Telephone Manufacturing Co., Ltd. April 19th. (United States, April 29th, 1921.)
11,046. "Process for electrolytically manufacturing compact metallic beryllium." H. Goldschmidt and A. Stock. April 19th.
11,047. "Electric cut-outs." A. Baderna. April 19th. (Italy, April 28th, 1921.)
11,060. "Apparatus for actuating electric indicators for engine-rooms, &c." R. Ainsley. April 20th.
11,079. "Operating devices for brakes, throttle valves, magnetos, &c., of automobiles." Calthorpe Motor Co. (1912), Ltd., E. C. Davison, and J. P. Hillhouse. April 20th.
11,095. "Electric heating fabric." B. R. Charles. April 20th.
11,114. "Sparking plugs." A. J. Bohringer and C. G. Pullin. April 20th.
11,121. "Insulating sleeves for electric transformers, &c." E. Hafely et Cie. Akt. Ges. April 20th. (Switzerland, April 21st, 1921.)
11,127. "Protective devices for dynamo-electric machines." W. E. M. Ayres and English Electric Co., Ltd. April 20th.
11,145. "Electric insulators." British Thomson-Houston Co., Ltd. (M. F. H. Gouverneur). April 20th.
11,147. "Measuring distances with the aid of sound." Atlas-Werke Akt. Ges. April 20th. (Germany, May 24th, 1921.)
11,154. "Telegraphic sending-keys." N. W. McLachlan. April 20th.
11,164. "Manufacture of electric thermal fabric." A. Negromanti. April 20th. (Italy, April 30th, 1921.)
11,165. "Switch apparatus for electric starters of internal-combustion engines." Scintilla. April 20th. (Switzerland, May 4th, 1921.)
11,173. "Manufacture of storage-battery separators." H. Wade (Gould Storage Battery Co.). April 20th.
11,184. "Asynchronous induction electric machine." V. Martinetto. April 20th. (Italy, July 2nd, 1921.)
11,201. "Tramcars." H. Sutton. April 21st.
11,223. "Sparking plugs." J. Judge. April 21st.
11,227. "Squirrel-cage rotors, &c." J. Jones. April 21st.
11,259. "Electro-magnetic apparatus." J. Erskine-Murray. April 21st.
11,266. "Sparking plugs." A. T. W. Goldsmith. April 21st.
11,274. "Receiving device for sound echoes." Atlas-Werke Akt. Ges. April 21st. (Germany, May 31st, 1921.)
11,275. "Measuring distance with the aid of sound impulses." Atlas-Werke Akt. Ges. April 21st. (Germany, May 27th, 1921.)
11,281. "Electric heating apparatus for hair-waving." P. Sartory. April 21st.
11,287. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. April 21st. (United States, March 29th.)
11,295. "Primary cells." Soc. Anon le Carbone. April 21st. (France, March 18th.)
11,300. "Alternating-current rectifiers." Siemens and Halske Akt. Ges. April 21st. (Germany, May 24th, 1921.)
11,302. "Repeaters for railway-signalling systems." General Electric Co., Ltd. April 21st.
11,304. "Instrument transformers." Landis & Gyr Akt. Ges. April 21st. (Switzerland, April 21st, 1921.)
11,305. "Prepayment meter." Landis & Gyr Akt. Ges. April 21st. (Switzerland, April 21st, 1921.)
11,306. "Supporting core on electrical measuring instruments." Landis and Gyr Akt. Ges. April 21st. (Switzerland, April 21st, 1921.)
11,314. "Automatic commutating switches." Anciens Etablissements Barbier, Bénard et Turenne. April 21st. (France, June 10th, 1921.)
11,316. "Sparking plug." Fauth & Mühlberger and W. Mühlberger. April 21st.
11,318. "Electric controllers." Electro-Mechanical Brake Co., Ltd., and M. J. Pattison. April 21st.
11,338. "Cover for protection of electric cables laid in the ground." D. Denholm. April 22nd.
11,349. "Multi-pole magnetic pendulum." B. J. Baker. April 22nd.
11,356. "Electric light fittings." F. Marshall. April 22nd.
11,363. "Electricity meters." R. Amberton. April 22nd.
11,367. "Telegraph instruments." A. Gordon and Siemens Bros. & Co., Ltd. April 22nd.
11,368. "Metering calls in telephone systems." D. A. Christian, W. G. Patterson, and Siemens Bros. & Co., Ltd. April 22nd.
11,369. "Circuit arrangements for operating automatic, &c., telephone systems." J. Berry, C. L. Peters, and Siemens Bros. & Co., Ltd. April 22nd.
11,379. "Automatic telephone systems." R. L. Murray and Telephone Manufacturing Co., Ltd. April 22nd.
11,380. "Telephone systems." Ges. für Drahtlose Telegraphie. April 22nd. (Germany, April 23rd, 1921.)
11,382. "Oil-immersed overload electric circuit-breakers." J. Hall. April 22nd.
11,383. "Manufacture of fuse-heads for electric firing." W. O. Littlebury and Nobel's Explosives Co., Ltd. April 22nd.
11,396. "Overhead construction for carrying electric conduits, &c." J. T. Thompson. April 22nd.
11,397. "Radio-communication, &c., signalling systems." J. Scott-Taggart. April 22nd.
11,401. "Telephone cables." Johnson & Phillips, Ltd., and G. C. Pearson. April 22nd.
11,759. "Candle lamps." E. Goodwin. April 18th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

27,772. "Vacuum or thermionic tubes or valves." J. H. Whittaker-Swinton. September 30th, 1920. (177,816.)
29,258. "Electric switches." J. F. Smith. January 24th, 1921. (177,826.)
30,425. "Dynamo-electric machines and method of constructing the same." J. B. Wiard. October 27th, 1920. (177,827.)
30,597. "Electric rivet-heaters." W. S. Johnson and J. W. Sheffer. October 29th, 1920. (177,828.)
33,626. "Means for bonding the metallic sheaths of electric conductors." M. J. Railing, F. G. Quance, and H. V. Owen. November 29th, 1920. (177,832.)
36,499. "Dynamo-electric machinery." W. B. Sayers. December 30th, 1920. (177,851.)
36,630. "Radio-transmitting apparatus." Western Electric Co., Ltd. December 31st, 1919. (156,159.)
36,668. "Primary electric batteries." Dr. O. Urbasch. December 28th, 1919. (156,171.)

1921.

297. "Acrials for use in wireless signalling." T. L. Eckersley. January 24th, 1921. (177,869.)
466. "Combined electric resistance and cut-out." Thor Electric Safety Lamp Co., Ltd., and T. Streton. January 5th, 1921. (177,874.)
827. "Wireless and light signalling devices." A. U. Sarnmark. December 1st, 1919. (156,760.)
853. "Incandescent electric lamps." N. Wise. February 7th, 1919. (156,778.)
859. "Spark-plugs for use in internal-combustion engines." F. L. Madler. June 3rd, 1919. (156,779.)
932. "Arrangement of brushes for disc-shaped commutators." F. Krupp Akt. Ges. February 17th, 1917. (157,088.)
1,364. "Devices for modulating the amplitude of electrical high-frequency oscillations." H. Vogt, Dr. J. Engl, and J. Massolle. April 7th, 1919. (157,437.)
1,427. "Dynamo-electric machines." J. Bijur. November 8th, 1919. (157,726.)
2,071. "Apparatus for recording the number of calls made by telephone by a subscriber." H. J. Webb and E. Webb. January 14th, 1921. (177,895.)
2,274. "Variable reactances." British Thomson-Houston Co., Ltd. (General Electric Co.). January 17th, 1921. (177,898.)
2,392. "Subscribers' instruments for automatic telephone systems." Siemens Bros. & Co., Ltd., and C. R. Riber. Jan. 18th, 1921. (Addition to 145,380.) (177,900.)
3,087. "Adapters for electric lampholders." E. Schattner. January 25th, 1921. (177,910.)
3,120. "Indicating instruments." British Thomson-Houston Co., Ltd. (General Electric Co.). January 25th, 1921. (177,911.)
3,175. "Aerials for wireless systems." G. P. Grenfell and J. Robinson. January 26th, 1921. (177,915.)
5,246. "Method of and means for measuring the length of electric waves." J. S. E. Townsend and J. H. Morrell. February 15th, 1921. (177,938.)
5,468. "Binding-posts for electro-medical apparatus." F. Read and E. E. Greville. February 17th, 1921. (177,941.)
6,141. "Electric incandescent lamp and holder therefor." E. De Lorenzi. February 23rd, 1921. (177,955.)
6,156. "Electric fittings." N. W. Scaife. February 23rd, 1921. (177,956.)
6,488. "Devices for testing the electric ignition in internal-combustion engines." W. Carr. February 26th, 1921. (177,962.)
7,744. "Automatic electric switches." W. J. Allen, W. D. Vick. March 11th, 1921. (177,975.)
8,235. "Commutators for dynamo-electric machines." G. Schroeder. March 16th, 1921. (177,978.)
8,876. "Automatic electric time-switch." A. J. Wheeler. March 23rd, 1921. (177,984.)
16,302. "Instruments for applying the rays emitted by radium and like radio-active substances." J. A. Hodgson, R. H. Walker, and J. H. R. Marshall. June 13th, 1921. (178,032.)
22,800. "Dynamo-electric machines." J. Bijur. November 8th, 1919. (Divided application on 157,725.) (168,382.)
27,069. "Process and apparatus for purifying gases by electricity." Siemens-Schuckertwerke Ges. October 22nd, 1920. (170,575.)
1922.

1922.

604. "Electric junction boxes or the like." M. J. Railing, F. G. Quance, and H. V. Owen. November 29th, 1920. (Divided application on 177,832.) (178,051.)
4,609. "Electric switches." P. Merguin. February 18th, 1921. (175,642.)